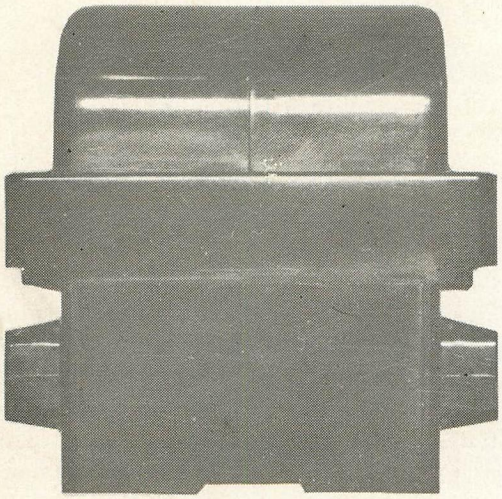
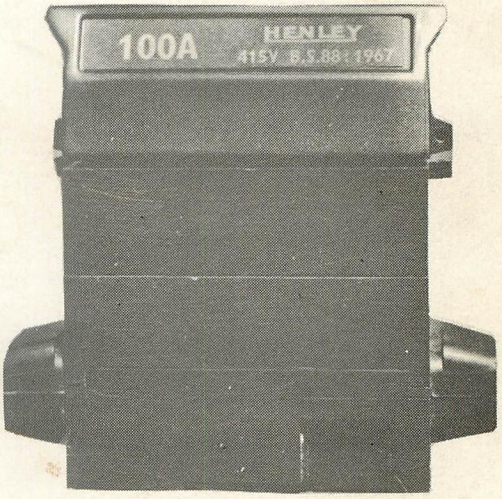
10th September, 1975.

MOULDED FUSE FITTING & FUSE LINK FOR SERVICES UP TO 100 A.



NILCROM



HENLEY/AEI

MOULDED FUSE FITTING AND FUSE LINK

INTRODUCTION

A new type of service fuse fitting and fuse link has been introduced for

(i) new 70A and 100A services

and (ii) 70A and 100A services where fuse fittings need replacement through damage etc. (see note below)

and is to come into use as follows:

70A Services

(a) It will be used on the Standard Domestic Service Board for all 70A services.

(b) For 70A services where the Standard Domestic Service Board is not installed the existing 70A Plastic Fuse Enclosure will be used until stocks are exhausted. Thereafter the new moulded fuse fitting and fuse link will be used.

Note: Stocks of the existing S.C.C. 70A fuse link will continue to be available for replacement purposes in existing porcelain fuse holders.

100A Services

For 100A services, other than where a service cabinet is installed, the 100A Cast Iron Cut-Out Box will continue to be used until stocks are exhausted.

Thereafter the new moulded fuse fitting and fuse link will be used.

Note: For old 70A and 100A multi-phase services, if one fuse fitting needs replacement due to damage or deterioration the other service fuse fittings must also be replaced.

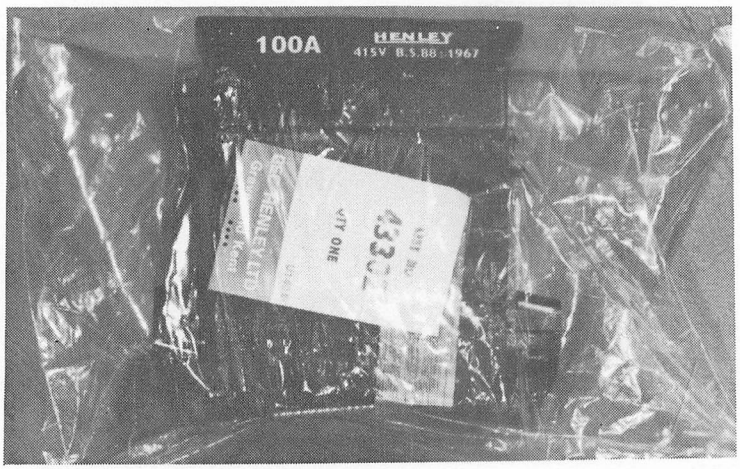
1. DETAILS OF FUSE FITTING, FUSE LINK AND NEUTRAL LINK

A. FUSE FITTING

The fuse fitting consists of a moulded bakelite fuse carrier and fuse base. Two types of fuse fitting have been offered to the Council.

(a) The Henley/A.E.I. fuse fitting (see photo below)

This will be issued complete with a 50 mm (2") long screw for mounting on plywood service boards. A M4 x 50 (2" x 5/32") metal thread screw and nut will be necessary for mounting on the Standard Domestic Service Board.



Henley/A.E.I. Fuse Fitting

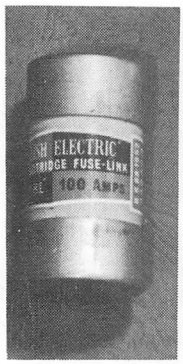
(b) The Nilcrom fuse fitting (see photo below)

A 25 mm (1") long wood screw will be necessary for mounting on plywood boards and a M4 x 30 ($1\frac{1}{4}$" X 5/32") metal thread screw and nut will be necessary for mounting on the Standard Domestic Service Board.

Nilcrom Fuse Fitting

B. FUSE LINK

The fuse link is a ferrule type cartridge (see photo below). It must only be used with the new fuse fitting (either HENLEY/A.E.I. or Nilcrom) and cannot be used as an alternative to existing types of fuse links. It is rated 100A but will be used on both 70A and 100A services.



Fuse Link

C. NEUTRAL LINK

The stock line of the neutral link to be used in conjunction with the new fuse fitting and fuse link will be as follows:-

Type of Service	Stock Line of Neutral Link
70A	0W0675
100A	0W0670

D. DISASSEMBLY OF FUSE FITTING

The fitting is disassembled by withdrawing the fuse carrier and removing the base cover after undoing the cover screw. (See figs. 1 and 2).

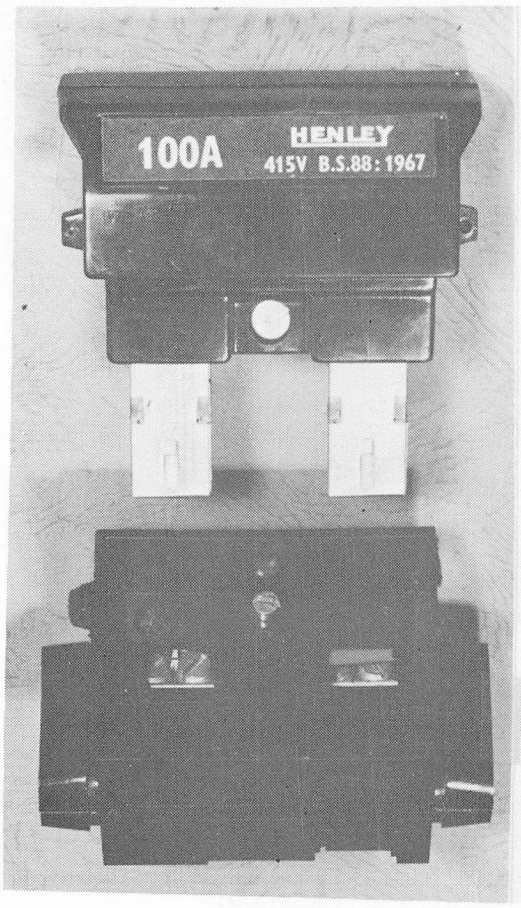


Fig. 1

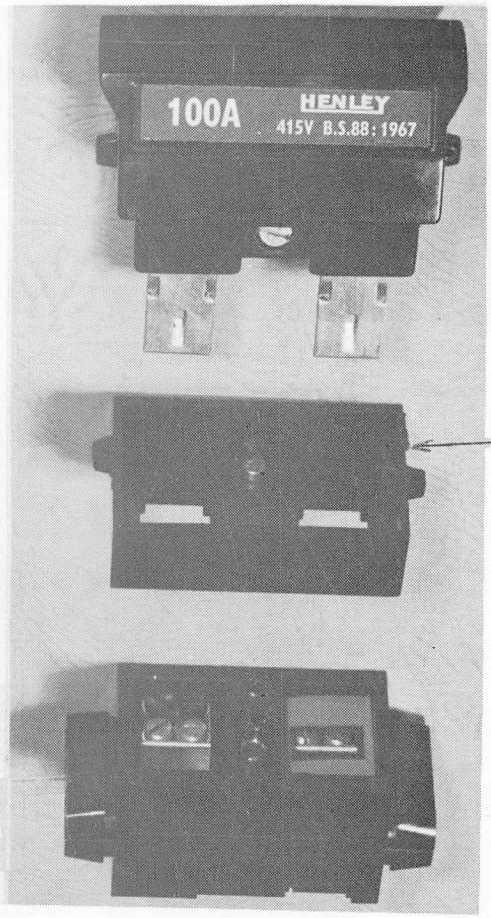


Fig. 2

Disassembling Fuse Fitting

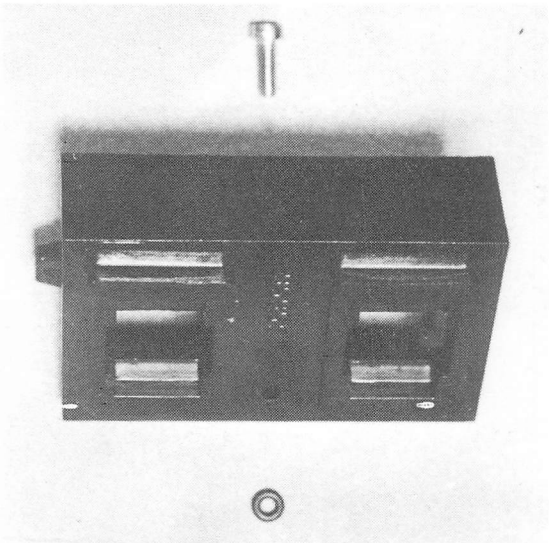


Fig. 3.

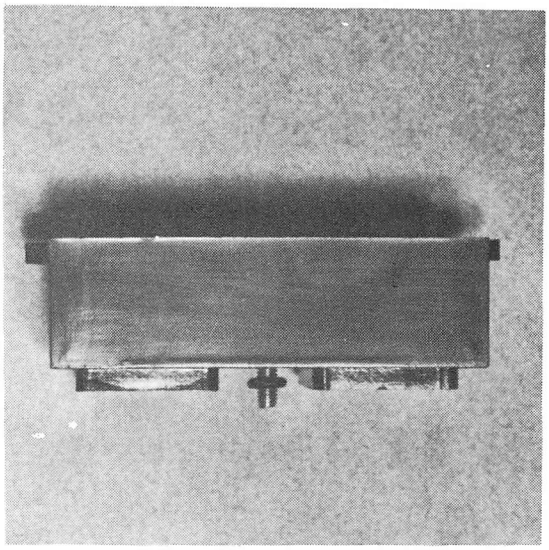


Fig. 4

Base Cover

In some Henley/A.E.I. fuse fittings, the cover screw may not be held captive in the cover. If this is so, insert the screw in the cover and push a small rubber "O" ring over the screw to hold it in the cover as shown in figures 3 and 4. Extra screws (S/L.I.S.1560) and "O" rings should be carried in case these small items are dropped and lost. Depots will be supplied with "O" rings.

2. INSTALLATION ON STANDARD DOMESTIC SERVICE BOARDS

A. NEW SERVICES

Although the normal procedure for installation of a new service should still be followed, certain alterations to the methods of mounting and lamping out are necessary due to the introduction of the new fuse and these will be outlined below.

The new fuse fitting is more compact than the previous box type and it is to be mounted on the front of the Standard Domestic Service Board for all services, including three phase services.

Henley/A.E.I.

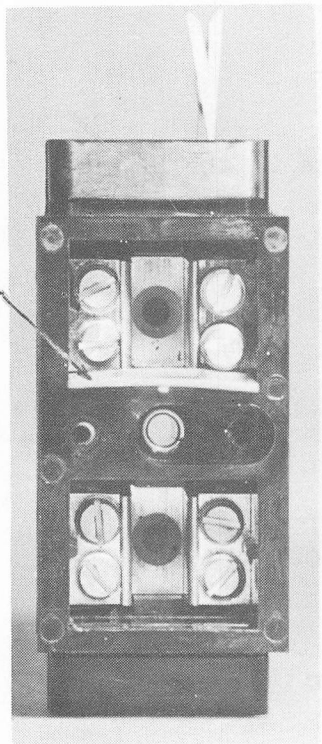


Fig. 5

Nilcrom

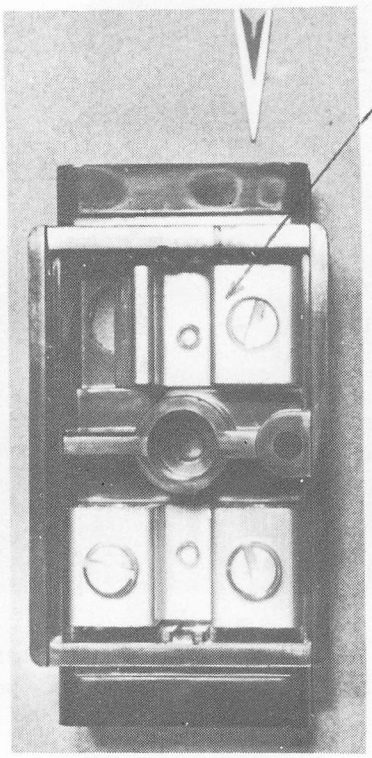
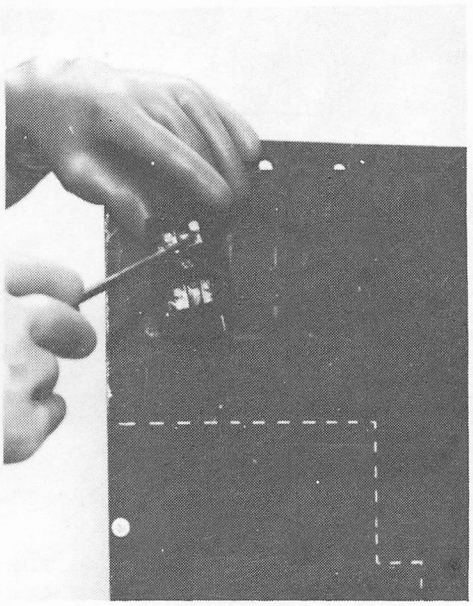


Fig. 6

Single Tunnel Terminal



Terminating Consumer Mains

Fig. 7

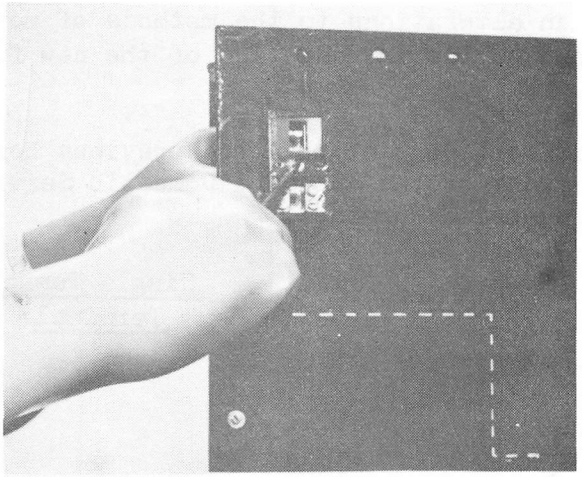
With a screwdriver, remove the cable entry "knock-out" in the fuse base which is shown by the arrow in fig.'s 5 and 6. Do not remove the other knock outs.

Terminate the consumers mains (as shown in fig. 7) in the top right hand end of the fuse base indicated by:-

(a) the red flag in the Henley/A.E.I. fuse fitting (as shown in fig. 5).

(b) the single tunnel terminal in the Nilcrom fuse fitting (as shown in fig. 6).

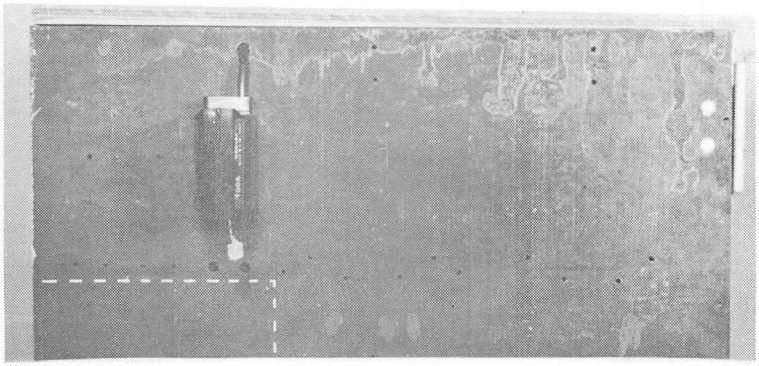
Fasten fuse base to the board by inserting a M4 x 50 (2" x 5/32") metal thread screw through the fuse base and tightening down using M4 (5/32") nut. Screw on fuse base cover. (Refer to Fig. 8).



Fastening Fuse Base to Board

Fig. 8

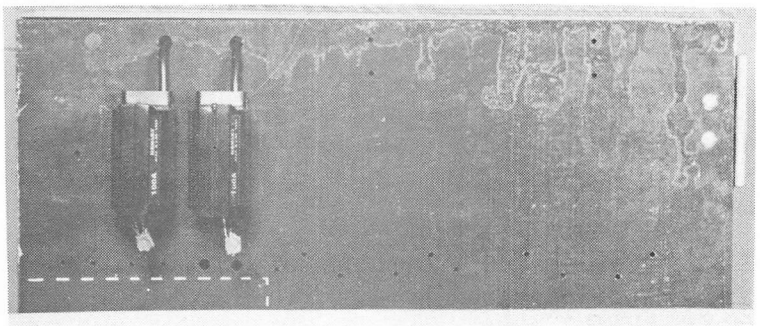
For single phase supply, mount the fuse in the right hand position as shown in fig. 9.



Single Phase Service

Fig. 9

For two phase supply, mount the fuses in the right hand and middle positions, leaving left hand position clear as shown in fig. 10.

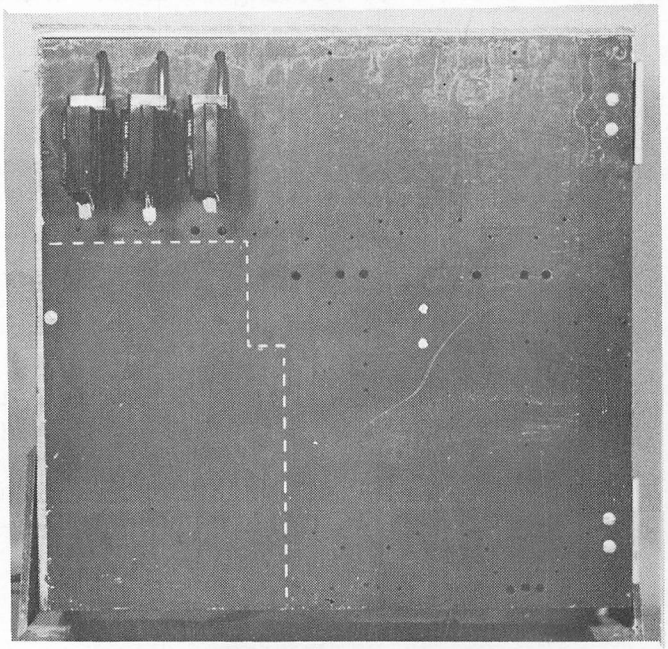


Two Phase Service

Fig. 10

For underground services, each unused phase must be terminated in an active link SL 0W0670 mounted on the front of the Standard Domestic Service Board where the fuses would normally be mounted.

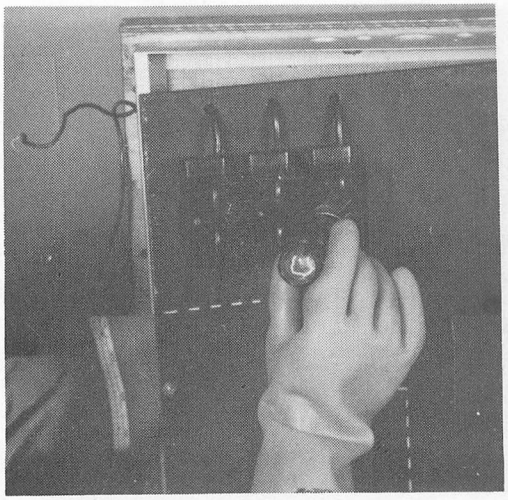
For three phase supply mount the fuses as shown by fig. 11.



Three Phase Service

Fig. 11

After all fuse fittings are fastened to the board, the fuse fittings must be lamped out. Note the method shown in fig. 12 for inserting the lamp probe into the base of the new fuse fitting. After carrying out the Full Standard Test, insert the fuse carriers and seal the fitting on the load side only (as shown by fig. 11). Do not install the fuse links but leave them behind the board for later insertion by Installation Inspector.



Access for Lamping-Out Procedure

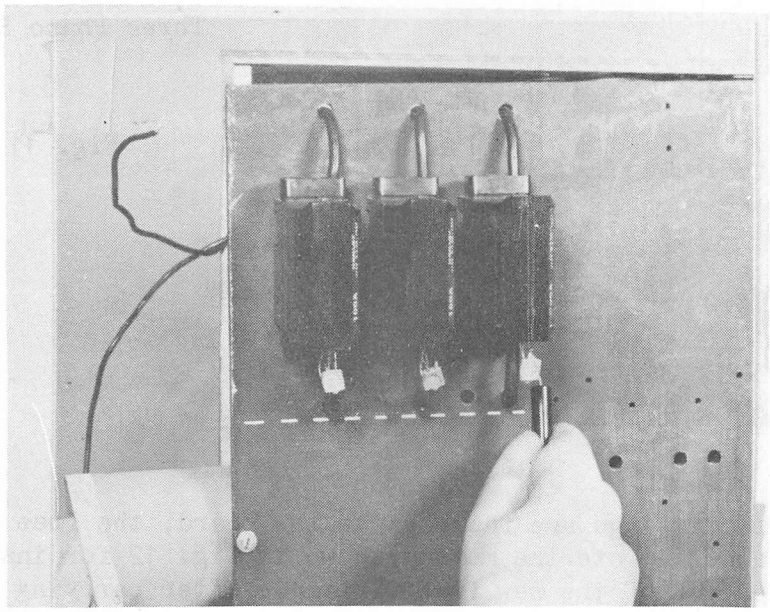
Fig. 12

B. DISCONNECTING & RECONNECTING EXISTING SERVICES

When carrying out polarity checks and standard testing procedures during Disconnecting and Reconnecting, it will be necessary to adopt some different techniques with the new moulded fuse fitting as shown below.

Polarity Check (Before fuse carriers are withdrawn)

The wandering probe should be pushed in between the customer wiring and the fuse base to contact the terminal of the fuse,



Access to Load Side for Lamping-Out Procedure

Fig. 13

and the fixed probe should then be brought into contact with the neutral link or temporary earth (as appropriate) to obtain the expected glow. (See fig. 13).

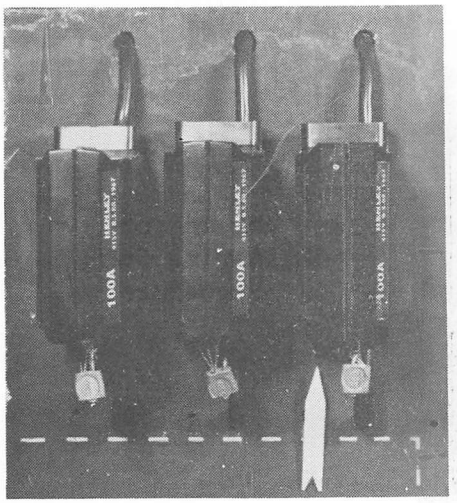


Fig. 14

Note: - Do NOT remove the "knock-out" (indicated by arrow in fig. 14) on the spare load-side terminal in order to carry out this test. However, where large sized customer wiring prohibits the wandering probe from being inserted in the above manner, access to the load-side terminal may be gained by breaking the spare knock-out which must be later plugged with a ball of self-amalgamating tape.

Identifying Phases

The service fuse is drawn by extracting the fuse carrier. DO NOT remove the base cover. All tests with the L.V. test lamps are to be carried out with the base cover in position.

Testing Fuse Links

The normal procedure for testing the fuse links before installing them is not practicable with the new fuse and the following procedure should be followed. After carrying out the Full Standard Test with all fuse carriers (containing fuse links) withdrawn, insert each carrier in turn into its own base with no other carriers inserted and prove active supply to the load side of the fuse (see fig. 15).

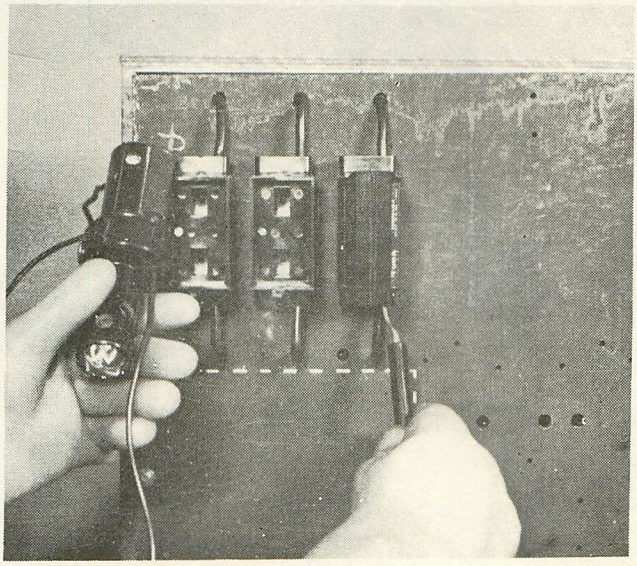


Fig. 15

Testing Fuse Links

This test must not be carried out with more than one fuse carrier (the one under test) inserted.

Where practicable check with the customer for satisfactory supply.

3. INSTALLATION OF 100 AMP. SERVICE BOARDS

A. ARRANGEMENT FOR INSTALLATION OF NEW 100 AMP. SERVICES & FOR REPLACEMENT OF OLD TYPE 'C' FUSE ASSEMBLIES

(i) Where the incoming mains are less than or equal to 19/.064 and where adequate length of tails exists for connection into the bases.

The fuse bases should be mounted with equal spacing as shown in Fig. 26. In the case of the Henley/A.E.I. fuse unit, the screw will be provided with the unit, but 25 mm screws (S/L IS5782) must be separately provided for the Nilcrom fuse unit. The neutral link (S/L EL0157) will accept cables up to and including 19/.064.

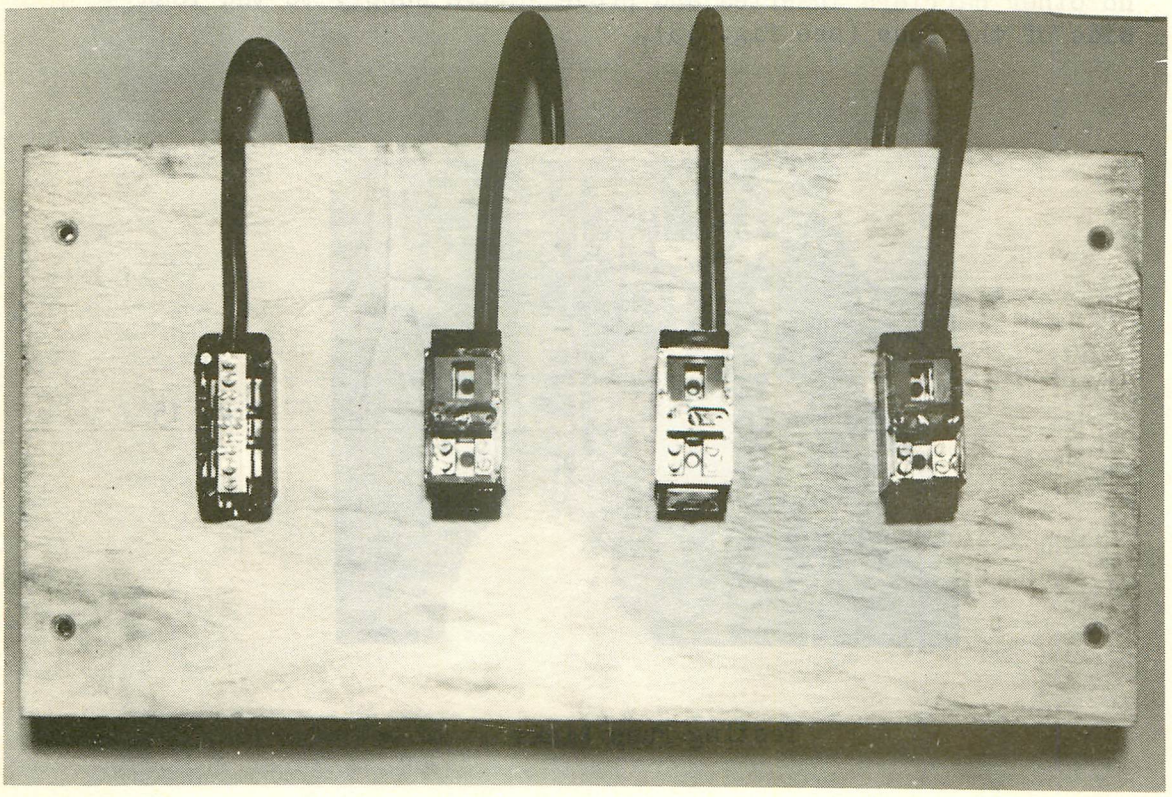


Fig. 26
POSITIONS OF THE FUSE BASES

(ii) Where the incoming mains are larger than 19/.064, or where the tails are not long enough for entry into the base, or where city underground services are to be terminated, plastic boxes with reducing links are to be installed before the fuse unit and 19/.064 cable is to be used for cabling between them.

The plastic container and fuse bases should be equally spaced as shown in Fig. 27.

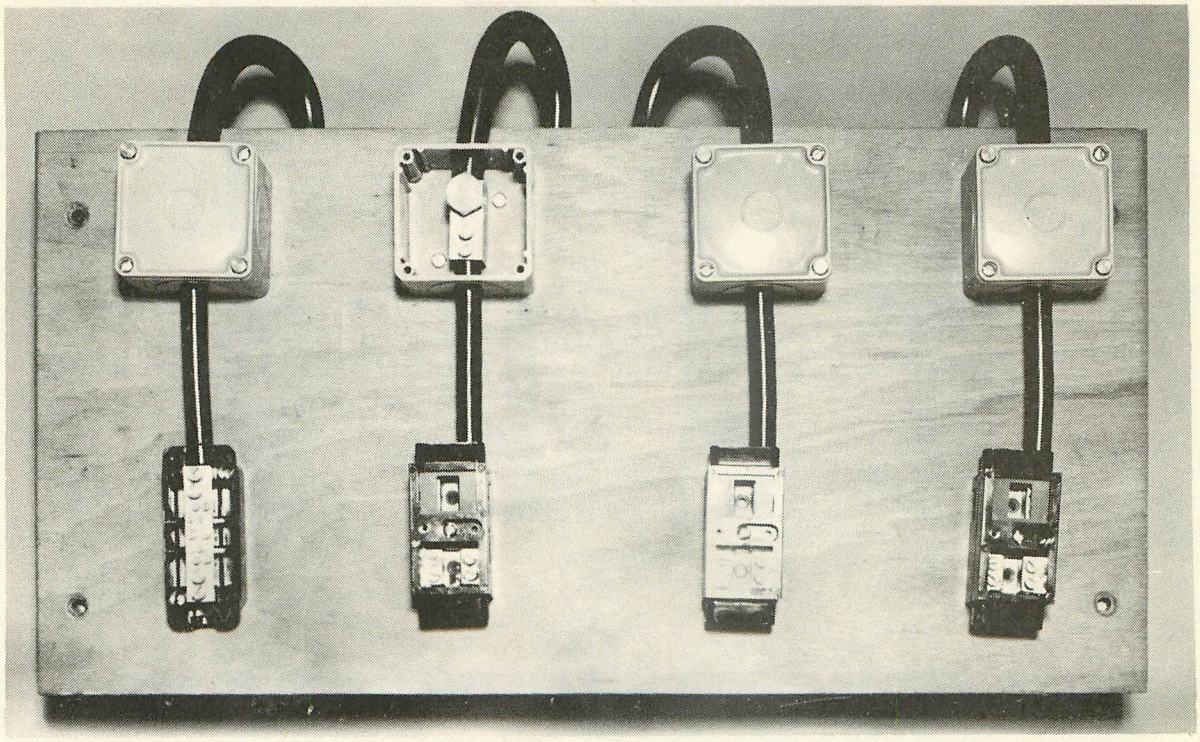


Fig. 27

POSITIONS FOR FUSE BASES & PLASTIC BOXES CONTAINING REDUCING LINKS

(iii) The Full Standard Tests should be carried out after installing the neutral and all phases at the board. The fuse carriers should then be sealed to the respective bases and the links suspended from the fuse unit with the excess tail of sealing wire. Where the reducing links are installed the container boxes should also be sealed. See Figs. 28(a) and 28(b).

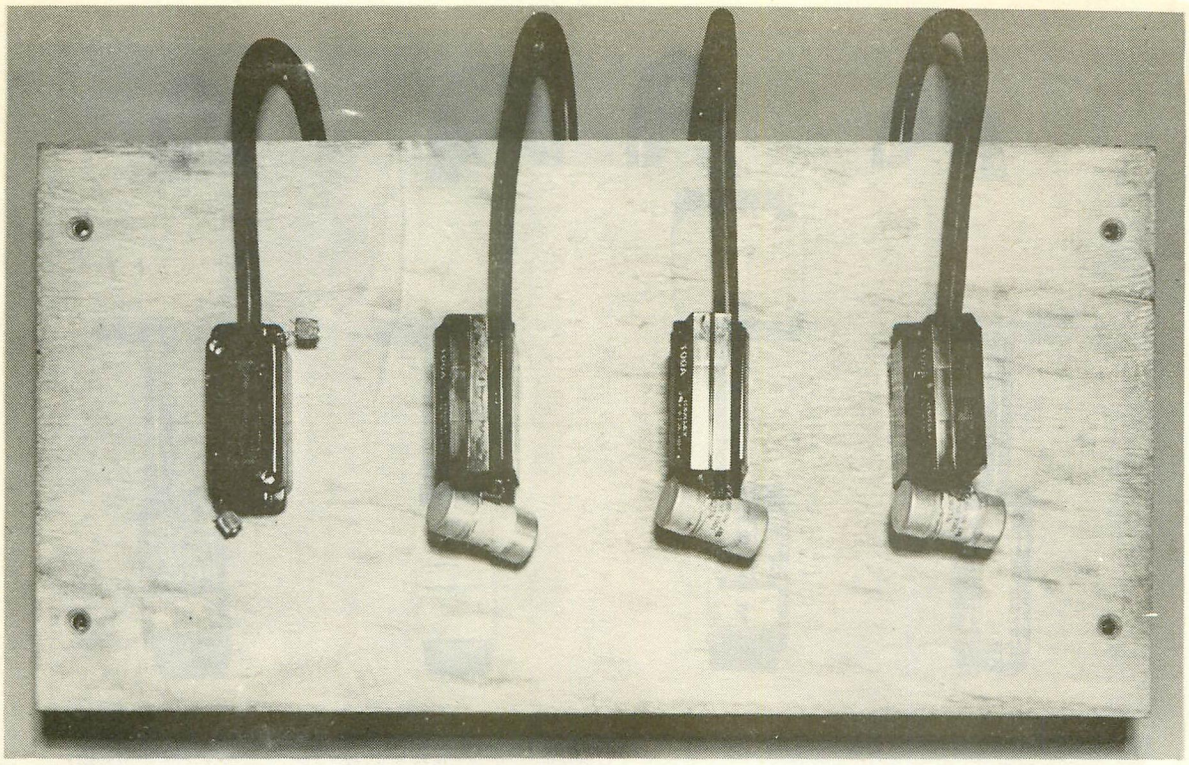


Fig. 28(a)

FUSE BASES WITH CARRIER SEALED IN POSITION
& FUSES TIED ON

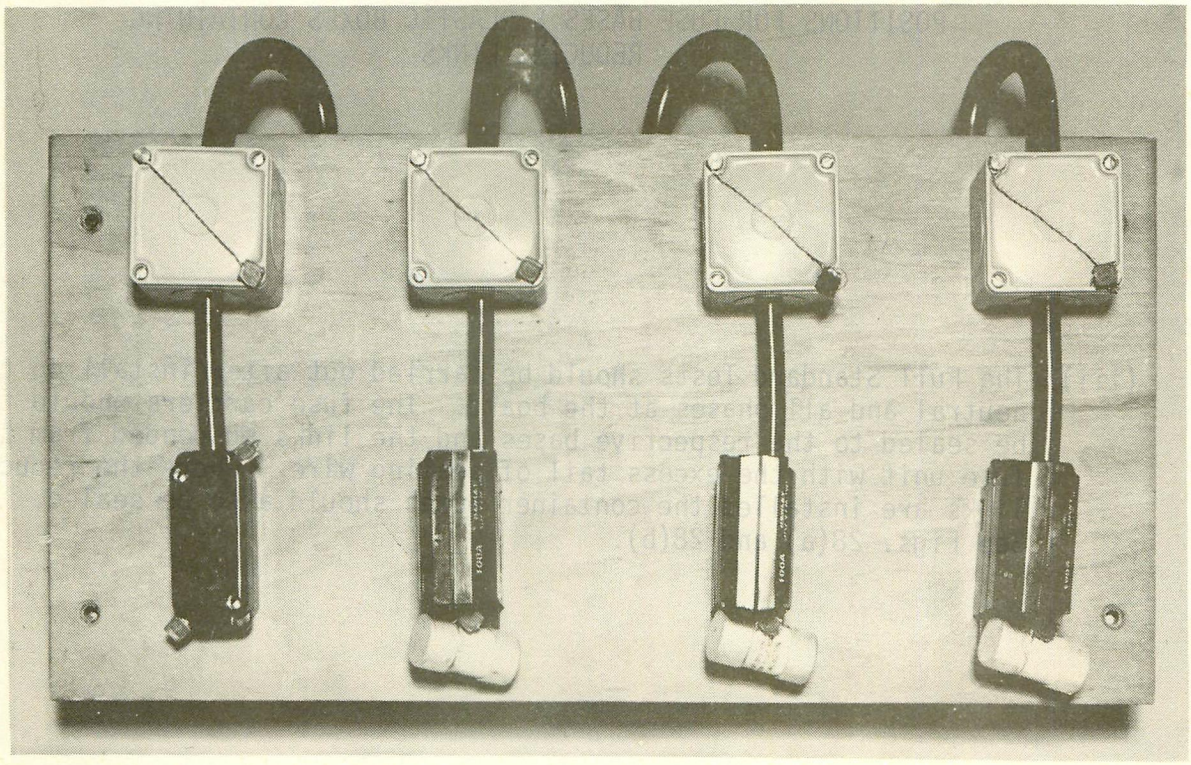


Fig. 28(b)

FUSE BASES WITH CARRIERS SEALED IN POSITION, FUSES
TIED ON & REDUCTION LINK BOXES

B. DISCONNECTING & RECONNECTING AN EXISTING SERVICE

Follow the same procedure previously set out in part 2.B. for domestic services. Access to the load side of the fuse is obtained as shown in Figs. 29(a) and 29(b).

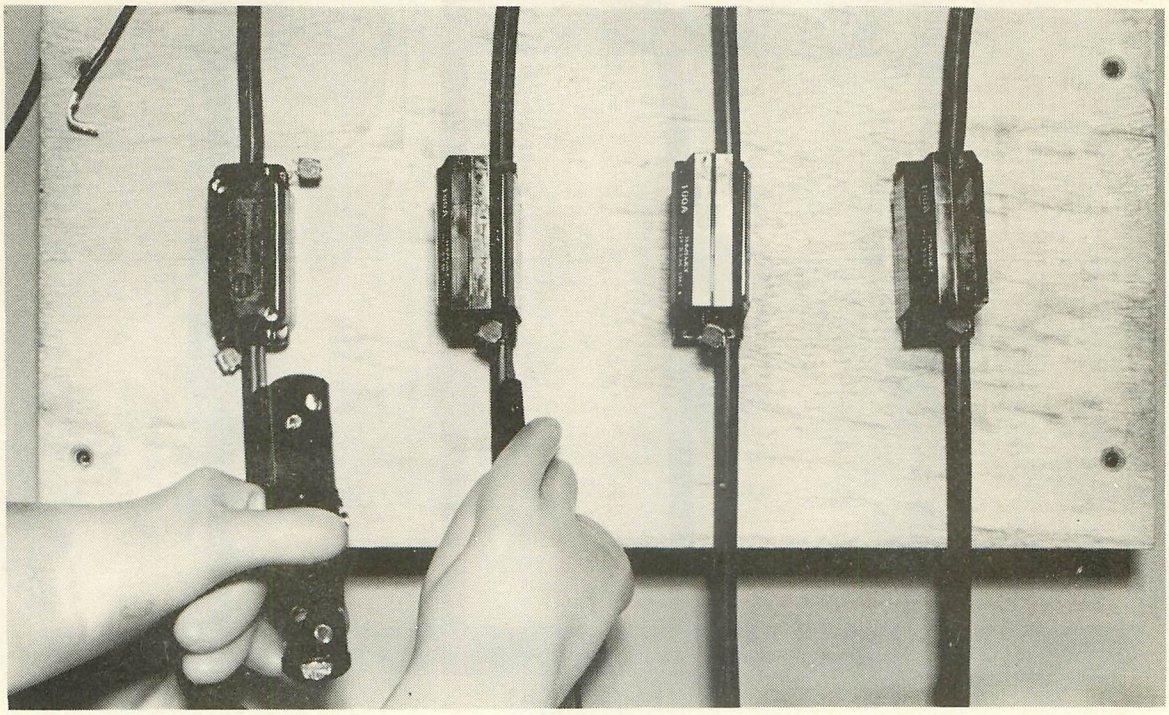


Fig. 29(a)

ACCESS TO THE LOAD SIDE OF FUSE

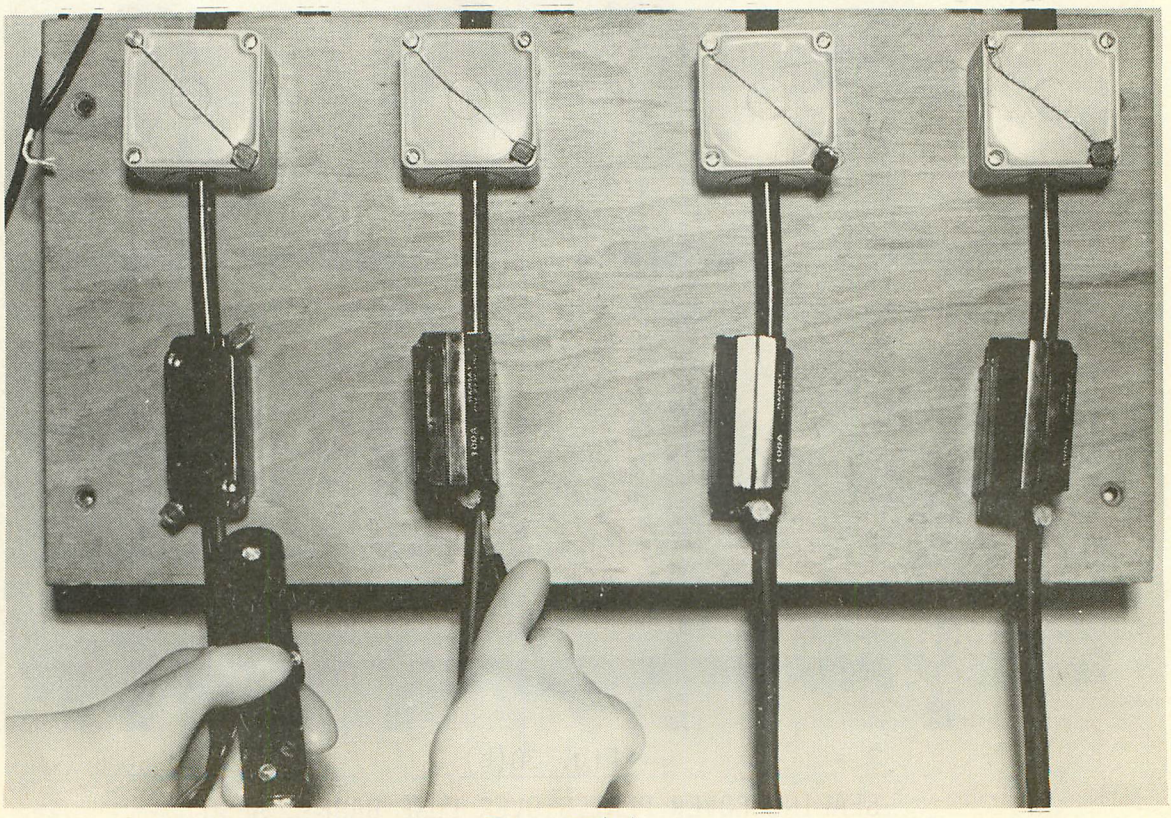


Fig. 29(b)

ACCESS TO THE LOAD SIDE OF FUSE WITH REDUCTION LINKS SHOWN

Where a Linesman must disconnect a customer at the service fuses, sealing cover plates (S/L OW0320) are to be sealed over the open bases. See Figs. 30(a) and 30(b).

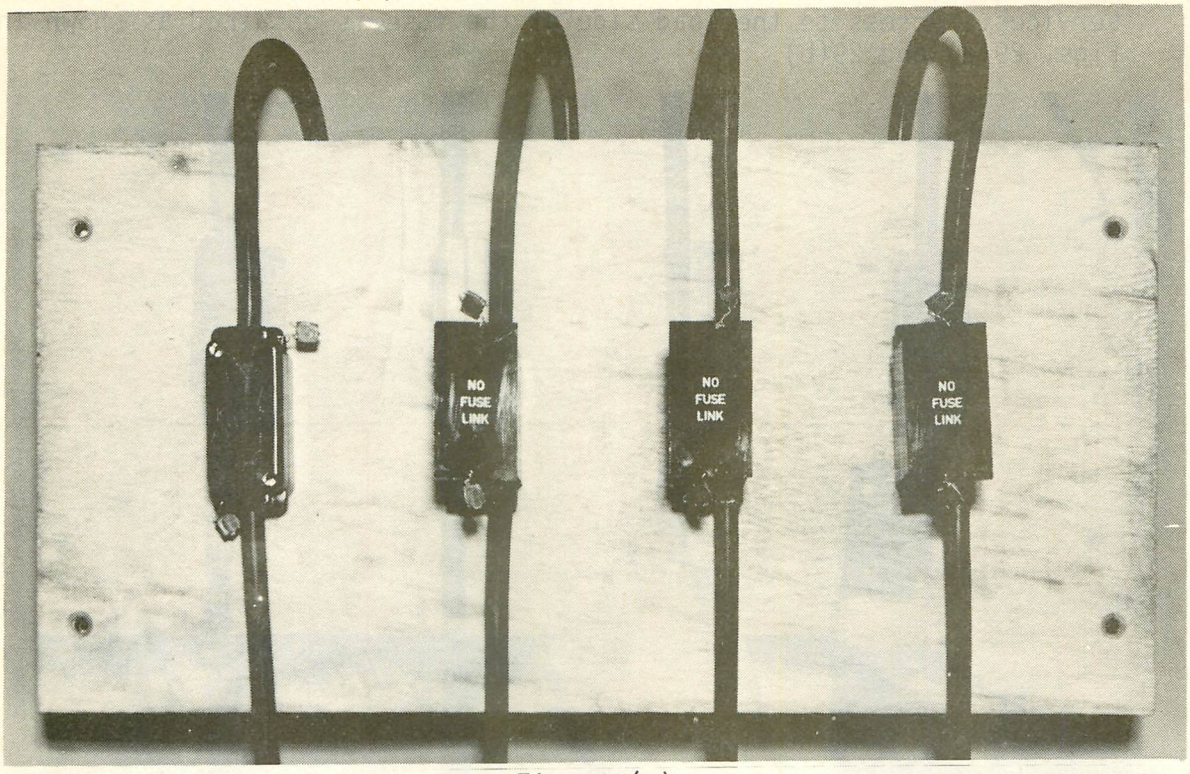


Fig. 30(a)

SEALING COVER PLATES OVER FUSE BASES

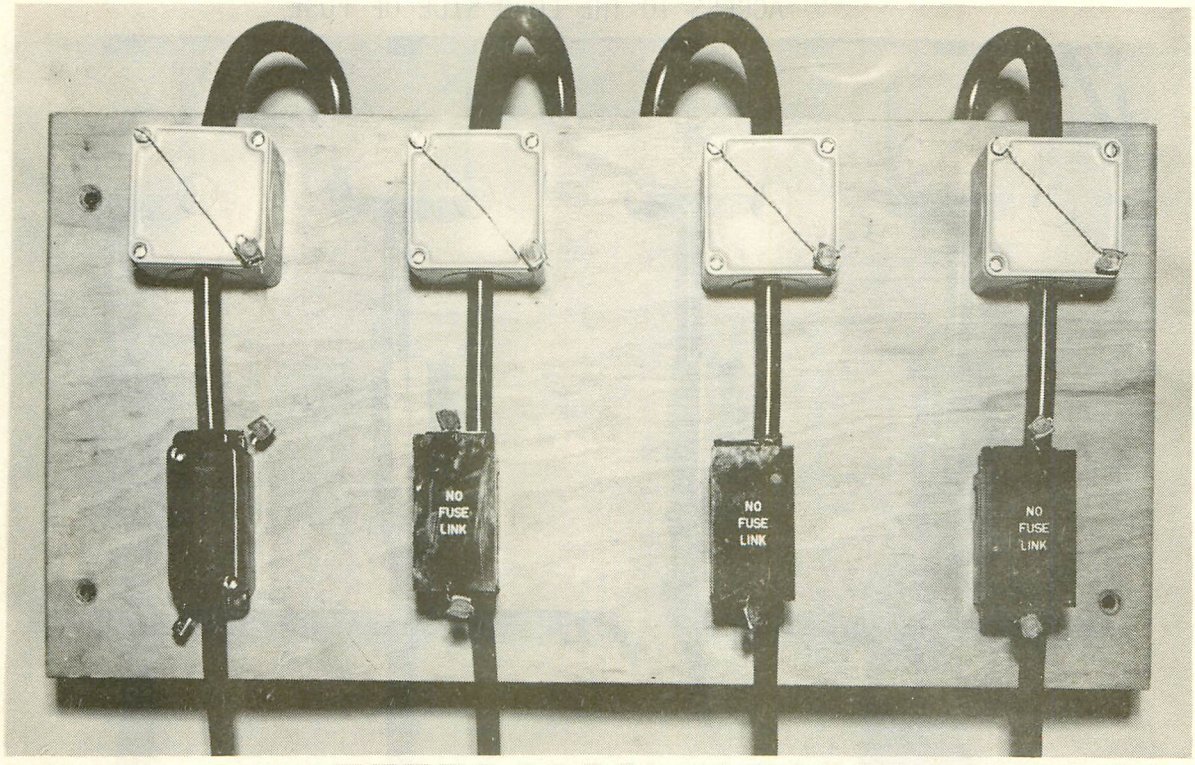


Fig. 30(b)

SEALING COVER PLATES OVER FUSE BASES, ALSO SHOWING REDUCTION LINK BOXES

4. INSERTING FUSE LINKS IN THE FUSE CARRIER

If tests and checks indicate that a fuse link is defective and has to be replaced, the following procedure is to be followed.

(a) Henley/AEI

1. Extract the fuse carrier from the fuse base.

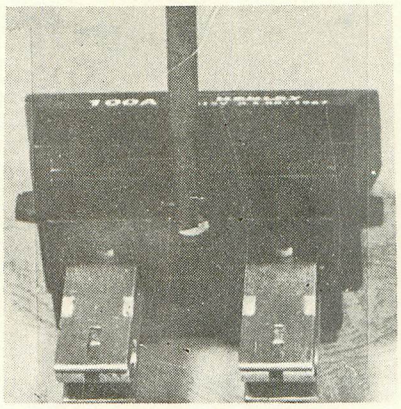


Fig. 16

2. Remove the nut and bolt and separate the two halves of the carrier.

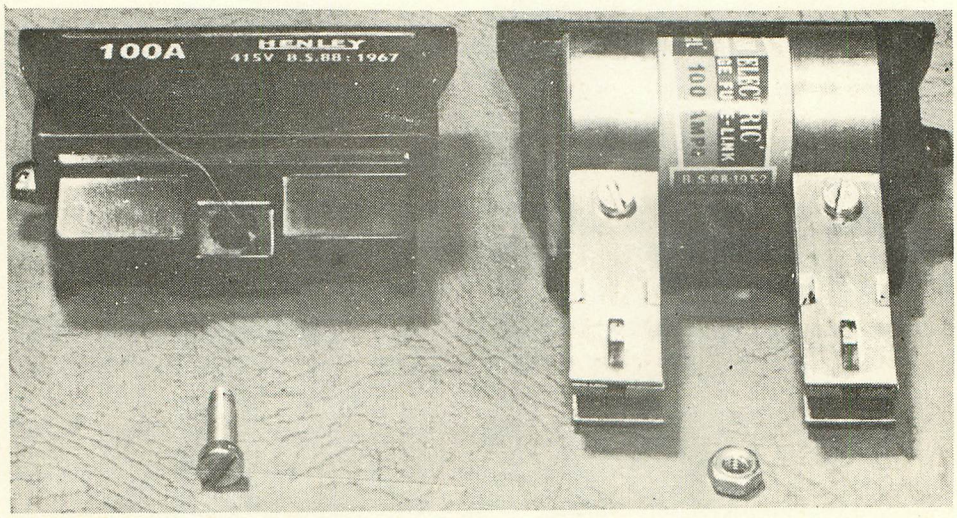


Fig. 17

3. Slacken and completely remove the screws holding the fuse contacts in position.

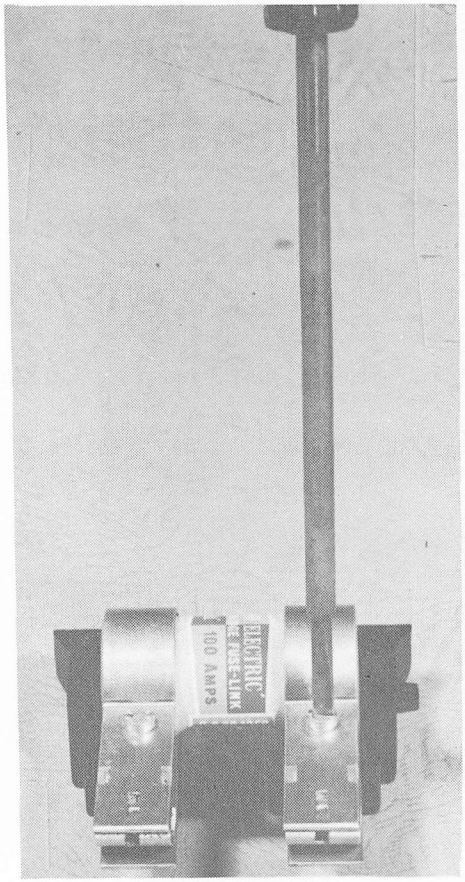


Fig. 18

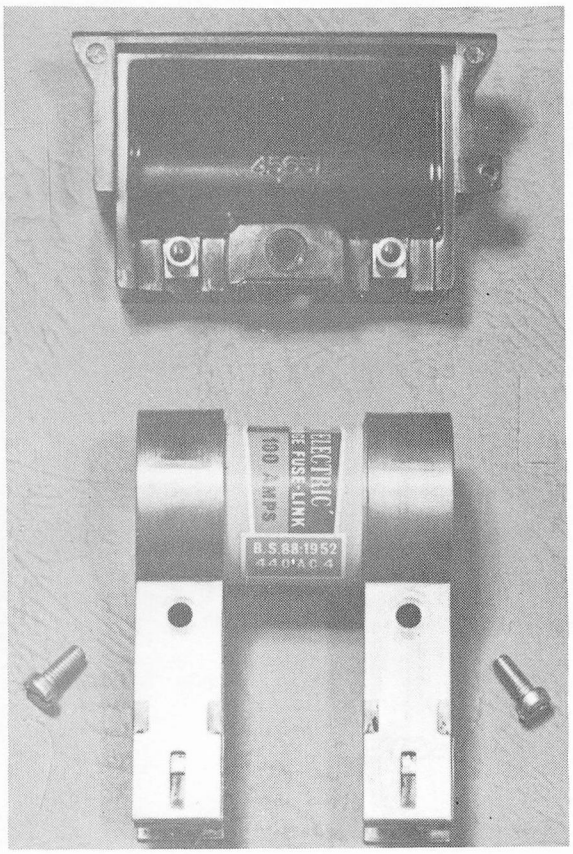


Fig. 19

4. Pull out the fuse contacts and insert the new fuse link.

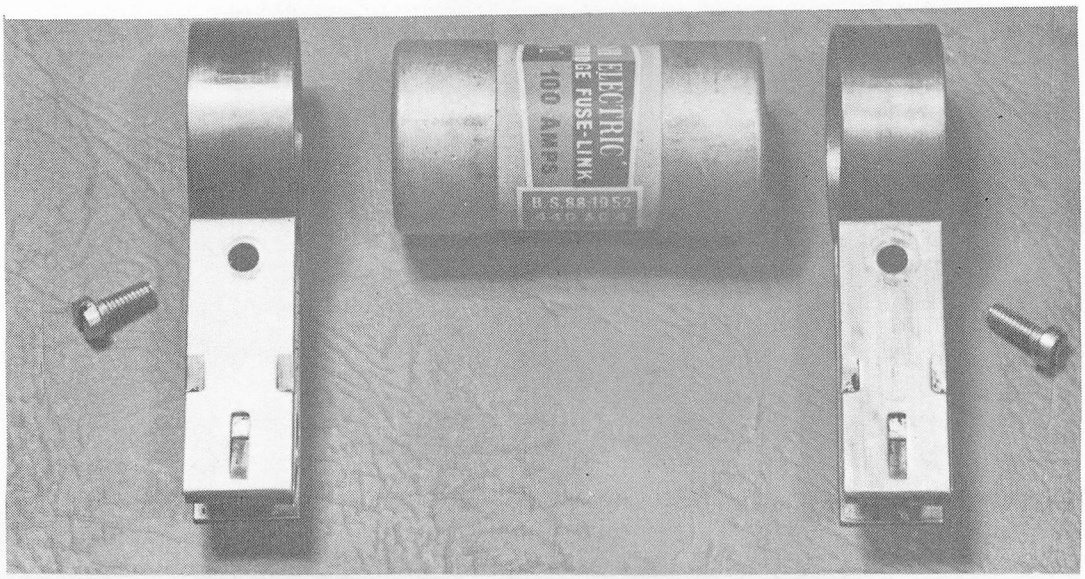


Fig. 20

5. Make sure that the large diameter holes in the fuse contact both face the same way. These holes fit over the brass spacers in one half of the fuse carrier.

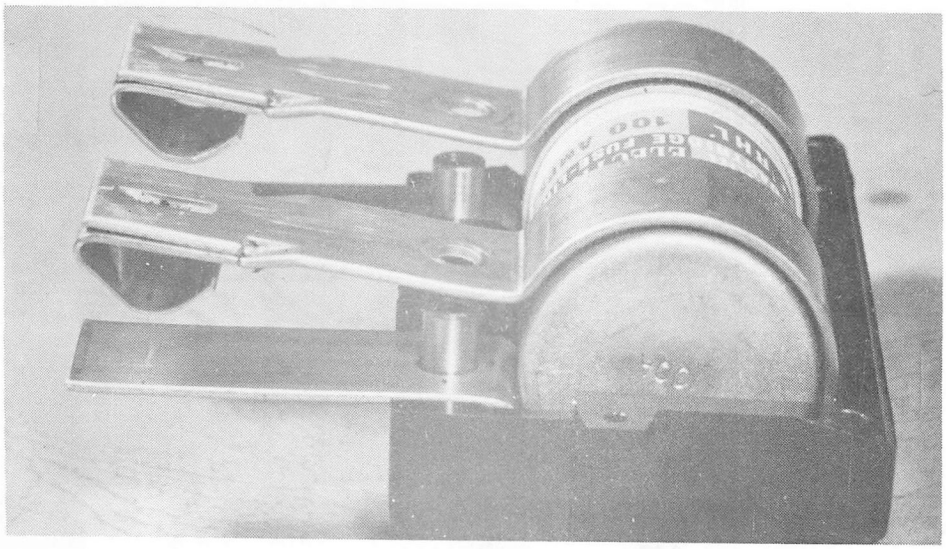


Fig. 21

6. Reassembly is a reversal of the above procedure.

(b) Nilcrom

1. Extract the fuse carrier from the fuse base.

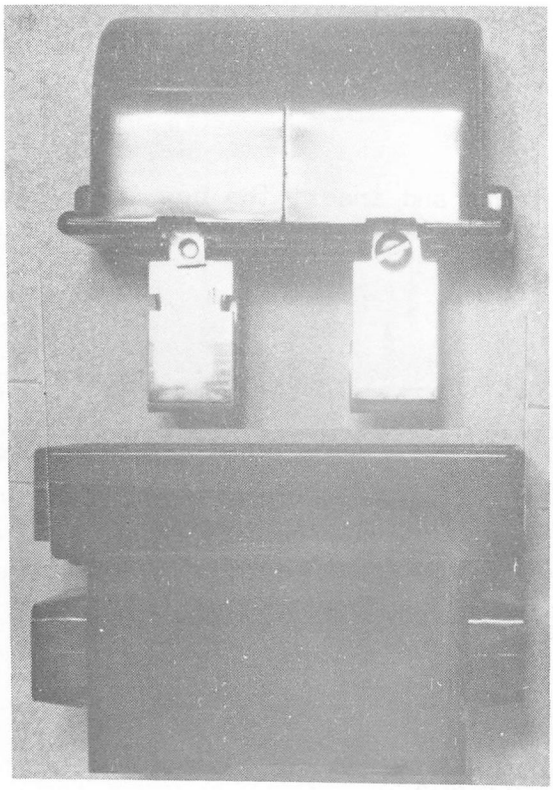


Fig. 22

2. Slacken off two (2) turns only (but do not remove) the two (2) screws in the fuse contacts.

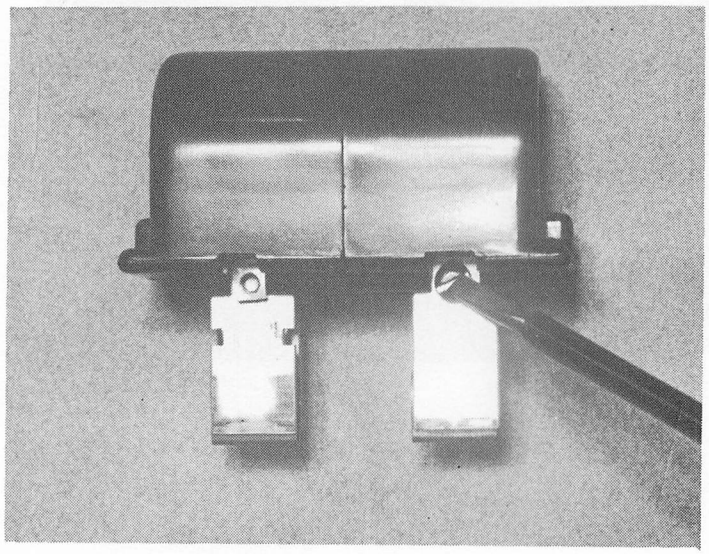


Fig. 23

3. Pull apart the carrier halves and remove the fuse link inside.

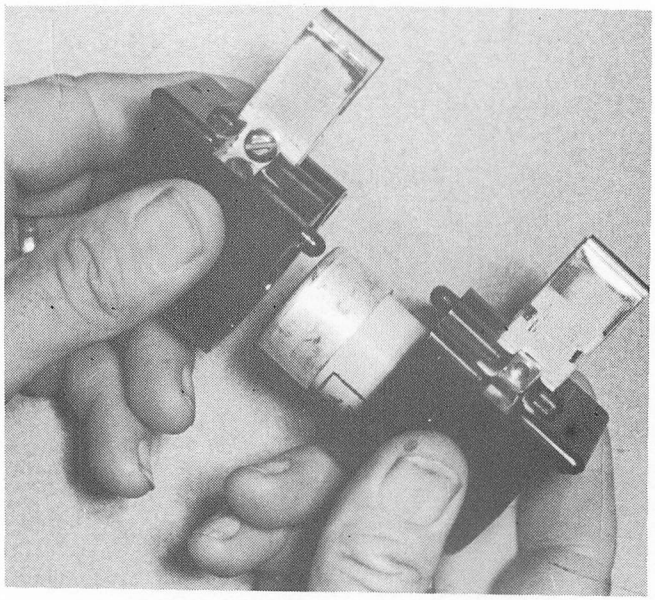


Fig. 24

4. Once the fuse link has been replaced, reassembly is a reversal of the above procedure.

Fig. 25

5. LIST OF MATERIAL REQUIRED

ITEM	STOCK LINE NUMBER
Fuse Fitting	OW 0330
Fuse Link	OW 0488
70A Neutral Link	OW 0675
Base Cover Screw $\frac{1}{2}$" x 4BA	IS 1560
Rubber "O" Ring	Supplied by MDE/CON. & E
Domestic Services	
Neutral Link Screws $\frac{3}{4}$" x 5/32" Whit. M.T.S.	IS 2134
Fuse Screws 2" x 5/32" Whit. M.T.S.	IS 2144
5/32" Whit. Nut	IN 1342
100A Services	
Nilcrom Fuse Screw 1" x 10G Wood Screw	IS 5782
100A Neutral Link	OW 0670

S E R V I C E S

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SECTION 2 - CONSTRUCTION

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SECTION 5 - TEMPORARY SUPPLY

SECTION 6 - WIRING DIAGRAMS

SECTION 7 - FREQUENCY INJECTION LOAD CONTROL RELAYS

SECTION 8 - PHASE SEQUENCE INDICATOR

SECTION 9 - SYSTEMS OF EARTHING

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SECTION 1 GENERAL

Service mains are those used to make the connection and provide supply from the general low voltage network to the customer's premises. Normally only one service is given per customer, even if the customer's premises consist of a number of separate buildings, provided that the buildings are all on one property.

Service cables are installed free to the customer provided that the distance, from the street alignment to the point on the customer's premises where the service terminates, is not greater than (23 metres) for an overhead service and (8 metres) for an underground service.

Procedure for Supply of Electricity to a New Customer

(1) An "Application for Supply of Electricity" form is received from the proposed customer, or his electrical contractor. An application from a contractor must include -

(i) name, address and licence number of electrical tradesman

(ii) anticipated load (number of lights, power outlets, size of electric range, hot water service etc.)

(iii) size of proposed consumer's mains.

(2) A Record Clerk (Treasury Branch) allocates a service card and a service number.

(3) A Service Marker visits the job, makes out a service sketch and leaves a card on site for the contractor.

(4) If a customer has himself submitted the application, a letter, setting out S.C.C. requirements as per Service Marker's sketch, is sent to that customer.

(5) The M.S.S. Section sends a "load slip" to the Mains District Engineer concerned if the proposed load is greater than twenty (20) kW. This enables the District Engineer to arrange for modifications to the network if necessary.

(6) A "Ready for Service" form is received at Head Office from the contractor.

(7) The service card is forwarded from Head Office to the Mains Depot concerned.

(8) A Linesman visits the job, decides on the phase or phases to which to connect the new service, checks the contractor's work against the Service Marker's sketch, and installs the service. The Linesman then records information on the back of the Service Marker's sketch, concerning -

(i) phase(s) to which service is connected

(ii) size of service cable used

(iii) length of service cable per leg

(iv) connected or not connected

(v) if not connected the reason is stated

(vi) Linesman's signature.

(9) The service card is returned to the Record Clerk after inspection of the service by the Foreman.

(10) A "Ready for Test" form is submitted by the contractor to the Electrical Installation Branch.

(11) The service card is given to an Installation Inspector, who inspects and tests the installation, accompanied by a Connecting Officer, who installs instruments (meters) if the installation is satisfactory.

(12) The service card is then returned to the records and filed.

Service Terminology and Definitions

The following terms are used in connection with overhead service construction. These terms are illustrated in the sketches at the end of this section.

(1) Service Line - The line erected and owned by the Council from the line pole in the street to the first support on private property, unless that first support exists solely to avoid crossing property in which case the service line extends to the second support. The line may consist of two or more conductors giving one, two or three phase supply. For smaller services, twin P.V.C. insulated conductors may be used.

(2) Excess Service Line - Overhead service wires erected by S.C.C. in excess of the length normally given free.

(3) Service Tap - That part of the service line from its point of support on the line pole or crossarm to its connection at the L.V. mains.

(4) Point of Attachment - The position at which the overhead service mains owned by the S.C.C. terminate and may be on a building or post. This termination is always on the supply side of the service fuses. Where service fuses are mounted in a box on a post or pole, the termination of any subsequent consumer's lines on a building is not part of the service and is not referred to as the point of attachment.

(5) Consumer's Line - Overhead mains erected by the consumer between the service line and the point of attachment.

(6) Consumer's Mains - All wiring, whether overhead line, underground cable, in conduit or run open through a building, from the point of attachment to the main switch board.

Note: In reports the general term "consumer's mains" should be avoided in favour of more specific parts of the consumer's mains concerned, e.g. connector box to service box, etc.

(7) Service Tails - Those parts of the service lines from the termination on the consumer's premises to the connection to the consumer's mains.

(8) Point of Entry - The point at which consumer's mains or underground service cable enter the consumer's building.

(9) Service Board - The general wooden service board, of various specified dimensions, which is mounted on wooden battens and button insulators.

The standard domestic hinged service and meter board together with its associated fittings will be described leter.

(10) Service Cabinet - Used for larger services of rating 100 to 400 amps., three phase.

(11) House Service Cabinet - Old single phase cabinet housing service fuse and one meter (no longer installed).

(12) Fuse Box (Cast Iron) - Box containing one service fuse of rating 70, 100, 200 or 300 amps. Use of these boxes is now diminishing in favour of standard domestic service boards and service cabinets.

(13) Service Fuse - High rupturing capacity (H.R.C.) fuse of ratings 70, 100, 200, 300 or 400 amps.

(14) Neutral Link - Link, mounted on service board, to which neutral conductor of consumer's mains, and neutral meter and customer's loops are connected.

(15) Energy Meter - Measures the electrical energy consumed by a customer over a period of time.

(16) Maximum Demand Indicating Meters - Measures the maximum peak load supplied to a customer within a meter reading period.

(17) Time Switch of Frequency Injection Relay - Devices to control the supply of electricity to off peak appliances.

(18) Customer's Loops - Cables supplied by the customer and left for connection by S.C.C. staff to S.C.C. fuse(s), neutral link and meters.

(19) Customer's Main Switch - The switch which controls the customer's installation. It is the property and responsibility of the customer, not the S.C.C.

Classes of Services

Services may be divided into the following classes:-

Domestic - supply to a residence, flats, home units

Commercial - supply to shops

Industrial - supply to factories

Special - includes supply to -

(i) Builders - for temporary use during building construction - supplied from L.V. network

(ii) Traffic Lights - supplied from L.V. network

(iii) P.M.G. Telephone Cabinets - supplied from S.L. network

(iv) Transport Department Waiting Sheds - supplied from S.L. network

(v) Welding Service - separate service to welders in a customer's premises - supplied from the nearest distribution centre via a special welder main

(vi) High Voltage Customer (H.V.C.) - a direct service from the high voltage network to customers with large loads.

Size of Overhead Low Voltage Services

Standard ratings of overhead low voltage services are -

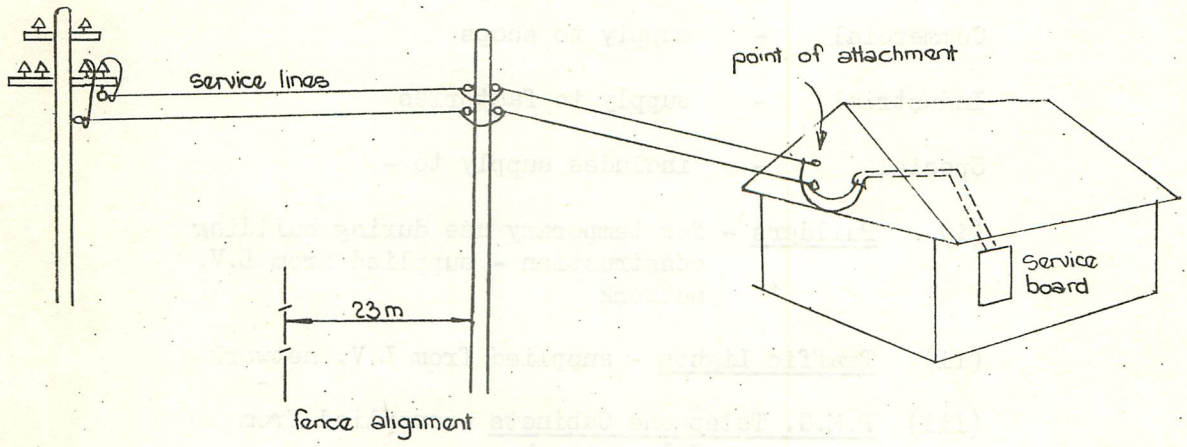
70 amps. - 2 or 4 x 7/.044 service cables

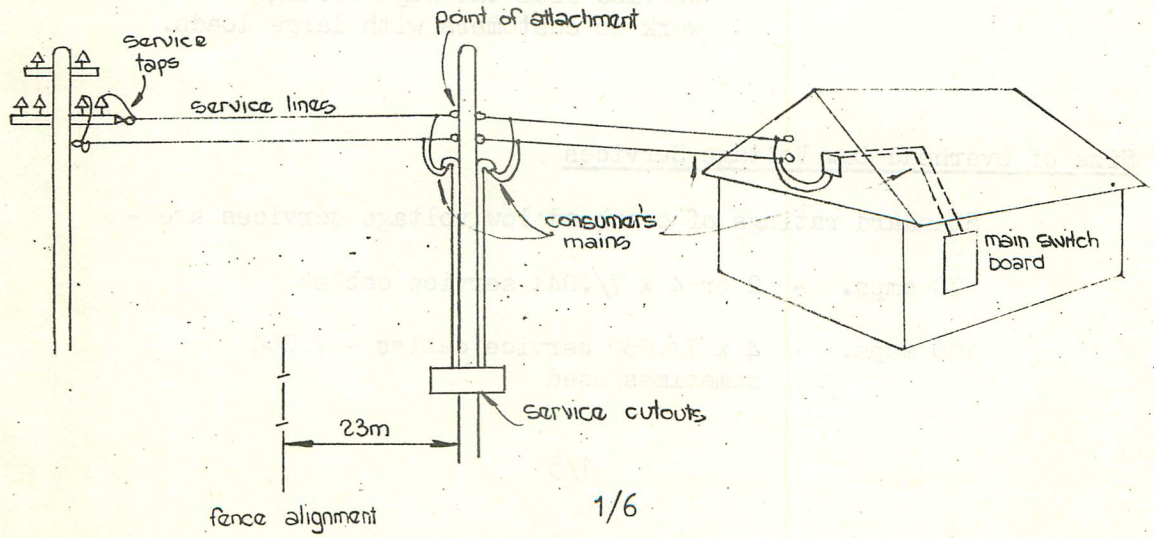
100 amps. - 4 x 7/.080 service cables - 7.064 sometimes used

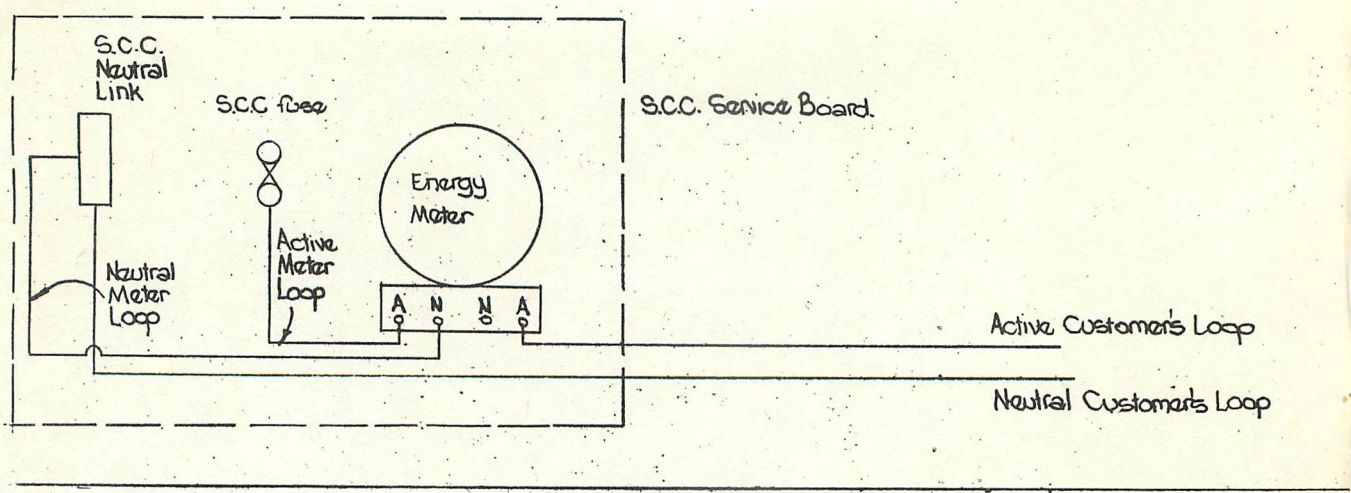
200 amps. - 4 x 19/.083 service cables - 19/.064 sometimes used

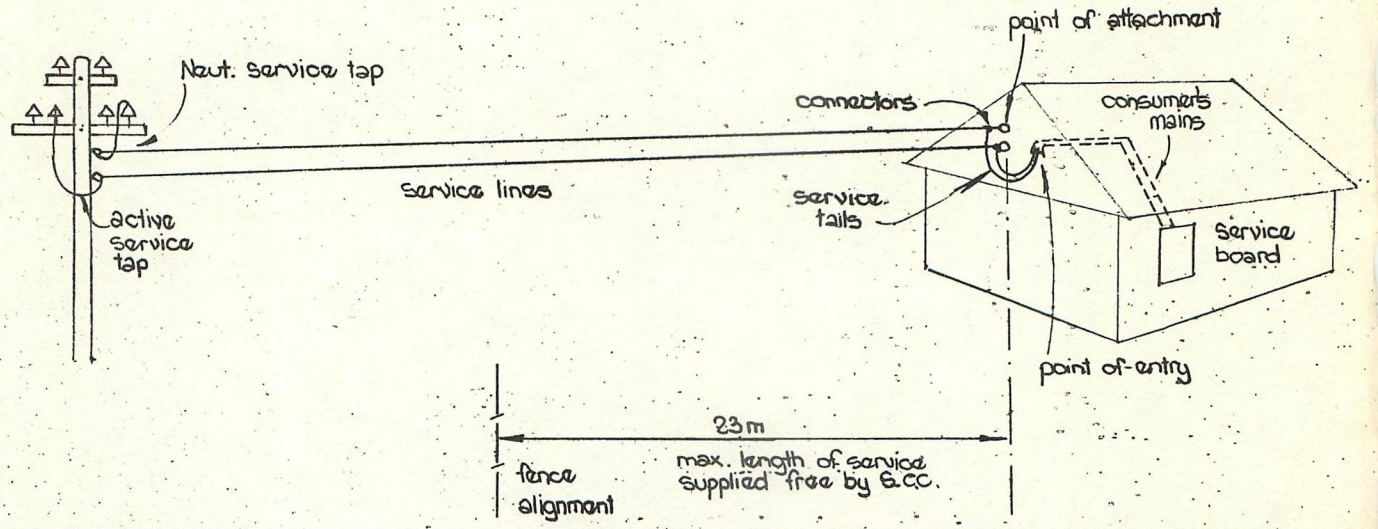
300 amps. - 8 x 19/.083 service cables

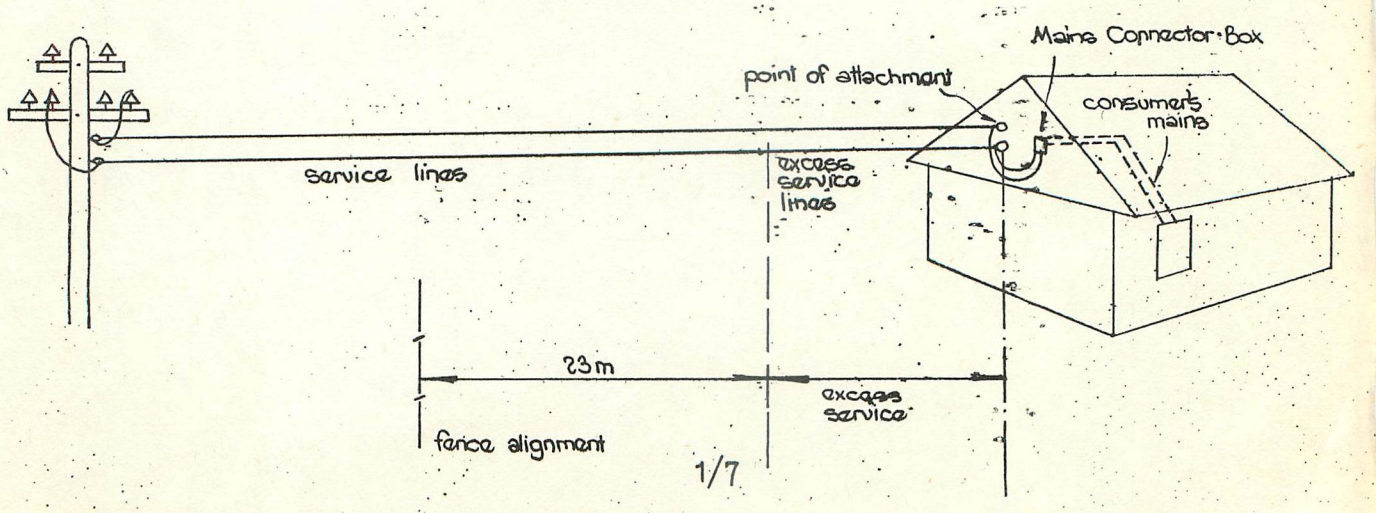
400 amps. - 8 x 19/.083 service cables.






S.C.C. Neutral Link
S.C.C. fuse
S.C.C. Service Board.
Energy Meter
Active Meter Loop
Neutral Meter Loop
A N N A
Active Customer's Loop
Neutral Customer's Loop


Neut. service tap
point of attachment
connectors
consumer's mains
service lines
service tails
service board
active service tap
point of entry
23m
max. length of service supplied free by S.C.C.
fence alignment


Mains Connector Box
point of attachment
consumer's mains
service lines
excess service lines
23m
excess service
fence alignment

SECTION 2 CONSTRUCTION

General

Construction requirements for overhead service lines in New South Wales are laid down in the Overhead Line Construction and Maintenance Regulations, 1962 which are part of the Electricity Development Act, 1945.

Special requirements for service lines are:-

(1) The conductors comprising the last span of a service line, between the last pole and the termination on a building or structure, shall be covered to the satisfaction of the Electricity Authority of New South Wales. S.C.C. policy is to use polyvinyl chloride (P.V.C.) as the covering material over the whole length of the service line. Such covered wires should not be regarded as insulated, but treated in the same way as bare conductors when working on them.

(2) Minimum size conductors permitted are -

harddrawn copper - 7/.044

harddrawn aluminium - 7/.064.

(3) Span lengths are governed by -

(i) maintenance of statutory ground clearances

(ii) maximum permitted conductor tension of 50 lb. per core for last span (S.C.C. requirement)

(iii) maximum length of 150 feet for last span.

(4) Clearances - as set out in Lesson 4. Clearances for service conductors crossing P.M.G. wires are shown on drawing D20022C.

The following are S.C.C. requirements concerning various aspects of service construction:-

(1) The minimum size service conductor to be used from the low voltage mains to a lead in pole across the street is 7/.064.

(2) All neutral service connections must be double clamped.

(3) At open points in the low voltage network all services should be connected to only one side of the open point, unless otherwise directed.

(4) Service taps of different polarity must be fixed to supporting reel insulators by marlin taped over with P. & B. tape, not by bare wire.

(5) On line poles a separate neutral line tap with two line clamps must be used for each multiphase service.

70 and 100 Amp. Services

Twin or single 7/.044 and 7/.064, and single 7/.080, P.V.C. cables are used for these services. Standard construction methods used for twin P.V.C. cables are shown on Drawings M6461P, M6462P, M6463P, M6464P and D32645E. Those for single core service cable up to 7/.080 are similar, only one (1) reel insulator together with a No. 4 stirrup or K straps, being used per termination.

Termination of twin P.V.C. service cable must be carried out in such a way that the two cores of the twin share the tension. To ensure this the following procedure is carried out:-

(1) Carefully tear conductors apart at house end to give sufficient length of free ends for make-off.

(2) Make off one core on reel insulator using standard tie as in drawing M6481P.

(3) Place this insulator and a vacant reel insulator on a suitable rigid support - (say 6" x ½" bolt).

(4) Form the second core around the vacant insulator and tie off evenly so that each core will share the tension when erected. The tie wires on each core must not rub on each other and the twisted ends of the ties must point outwards.

(5) Attach the insulators with conductors made off to service fitting at the point of attachment. Mount the supporting 'Y' pin at right angles to the run of service. Install the 'E' stirrup fittings so that they are free to follow the line of the installed service as it moves from side to side in the wind. Check the strength of the anchoring support on the house by means of a hard tug on the termination fittings.

(6) Erect and tension the service line to approximately 225 N (about 50 lb.) per wire (450 N per twin). Terminate the pole end in a similar manner to the house end and connect the service.

The above procedure refers to the erection of one twin cable, i.e. a single phase service. Three and four core services usually consist of two twin service cables terminated 300 mm apart at the point of attachment on separate bolts. Suspended services are erected as indicated in drawing M6462P.

Fittings for these services are shown on drawings D11471C and D13366E and are further described as follows:-

'E' Stirrup - Mark 3 - used in conjunction with Y pin - Mark 3 to support one (1) No. 8 reel insulator at the point of attachment.

'E' Stirrup - Mark 4 - used in conjunction with Y pin - Mark 4 to support two (2) No. 8 reel insulators at the point of attachment.

'F' Clip and 'U' Hook - used as required at house end to support 'E' stirrup. See drawing M6464P.

'G' Wall Spike - normally used only where replacement of similar construction is necessary.

'K' Shackle Straps - used to support one, or a pair of, reel insulators at the pole end, in conjunction with 'Y' pins.

'J' Eye Spike - mounted on wood poles to support 'K' straps.

'Y' Pins - used in conjunction with 'E' stirrups or 'K' straps as described above.

'L' Bracket - used at the point of attachment when old four core services, supported by one bolt, are replaced by the standard two twin cables. Use of this bracket obviates the need to fit another supporting bolt to the house.

Plastic Cover - used to insulate Type A line clamps on service lines at the point of attachment. Line clamps larger than Type A are insulated with three (3) half lapped layers of P.V.C. tape followed by one (1) half lapped layer of P. & B. tape.

Neutral Service Taps on Line Poles - up to three (3) 7/.044 or 7/.064 neutral service taps may be connected by the same two line clamps to the low voltage distributor neutral, provided that the three (3) services are fed from the same phase.

- When services are fed from different phases interconnection of neutral service taps is not permitted.

For example - Three (3) 7/.044 or 7/.064 services fed from the same phase - two (2) only line clamps are required for the neutral, or

Three (3) 7/.044 or 7/.064 services on the same pole each fed from a different phase - six (6) line clamps are required on distributor neutral.

200 Amp. to 400 Amp. Services

Single core 19/.064 and 19/.083 P.V.C. cables are used for these services. Termination used is shown on drawing D32638E. The No. 11

shackle insulator shown is supported with a $\frac{1}{2}$ inch diameter bolt and nut together with 'K' straps. These services are invariably three phase and are usually terminated at the pole on a special service crossarm erected either horizontally below the low voltage mains or vertically between the ends of other horizontal crossarms.

When erecting services requiring two (2) legs per phase, i.e. 300/400 amps., the service cable is made off at the pole end, "leaving enough tail to make connection to the L.V. distributor mains" passed around the insulator at the point of attachment and tensioned back to the pole.

Double bolted tee clamps are used to connect the consumer's mains to the service mains. These clamps must be completely insulated.

Service Boards

Service boards in use by S.C.C. are the following types -

(1) Hinged Service Board - This is the standard domestic service and meter board for 70 amp. services, of one, two or three phases. It will be described in detail later in this lesson.

(2) Service Cabinet - This cabinet is used for larger services, from 100 to 400 amps. rating. It contains fuses and neutral link only. New services will have the cabinet installed on an 475 x 525 mm W. board on battens fixed by the contractor. An increase of service may require the cabinet to be erected on an existing *16" x 26" W. board. The cabinet is to be connected N-A-B-C, from left to right when looking at the cabinet. In special cases the cabinet may be mounted on the customer's panel at the direction of the M.S.O.

Cabinet is to be mounted with hinges on the left hand side. A space of *3" is required on the left, °6" on right and ø12" at top or bottom depending on whether supply is O.H. or U.G. The cabinet is to be mounted directly on the meter board which shall be mounted directly on the battens.

*75 mm, °150 mm, ø300 mm

*Approximately 400 x 650 mm

Cables up to 185 mm^2 (37/.103) are connected by means of the cable connector for type "B" cabinet.

Cables above 185 mm^2 shall not be connected directly to the cabinet, but the contractor will supply a copper bar 225 x 31.5 x 6.3 mm suitably connected to the consumer's mains and insulated.

The correct size of rubber grommets should be used to seal around the cable or busbar and allow the lid to close. Where double insulation is used on 185 mm^2 cable it may be necessary to omit the grommets to allow the lid to close.

(3) General Service Boards - These boards consist of five ply weatherboard in various sizes and are used for mounting of Council's service fuses, neutral link, meters and other associated metering equipment. The size, number and arrangement of the boards depends on the number of phases of supply to be provided, the current rating of the service fuses and the amount of metering equipment necessary.

The boards are mounted on vertical wooden battens supplied by the customer. Button insulators are interposed between the battens and the service boards. Service fuses mounted on these boards are enclosed in cast metal boxes and can have ratings of 70, 100, 200 or 300 amps.

Extent of Work by Linesman at Service Board

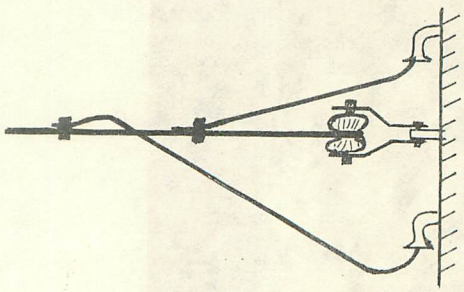
New Service - For a new service linesmen mount the service board, fix to it the service fuse(s) and neutral link, connect the consumer's mains to the supply side of the service fuse(s) and neutral link and leave the service fuse(s) for later insertion by Installation Branch staff after their checks.

Existing Service - At an existing service linesmen move the service board to a new position or change the board in the same position, provided that the service involves no more than three (3) instruments (e.g. three (3) meters or two (2) meters and

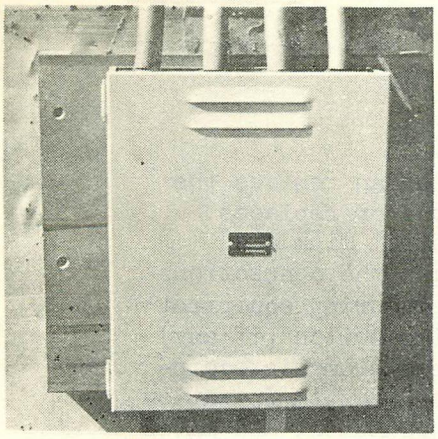
one (1) time switch). In these cases the linesman removes the existing equipment and service board, relocates or replaces the board and mounts the service fuse(s), neutral link and metering equipment on the board. He then makes the connections to the service fuse(s), neutral link and the metering equipment as far as the supply side of the meter and time switch (if any) terminals. He does not connect wiring to the customer's equipment, but summons an Emergency Service Officer (System Operation Branch) who checks phasing at the customer's equipment and makes the final connections. This procedure is explained in more detail later in this lesson.

CONNECTION OF CONSUMER'S MAINS

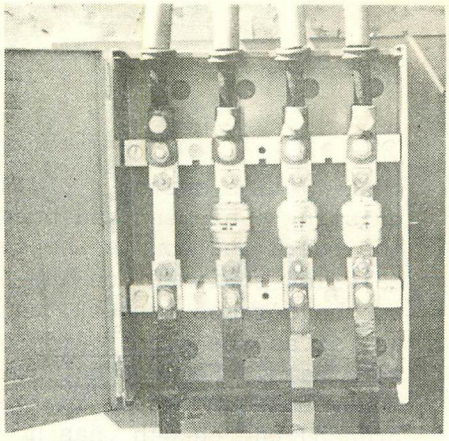
If the consumer's mains are not to terminate in a connector box, the bellmouth shall preferably be above the Point of Attachment. If below the Point of Attachment, sufficient loops shall be left to enable the connectors to the service mains to be made from the top as shown in sketch.



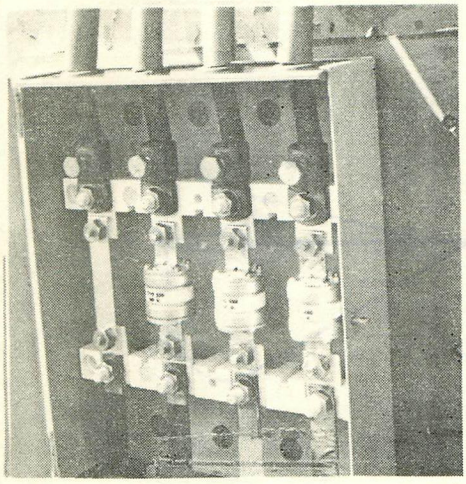
SERVICE CABINET



A.



B.



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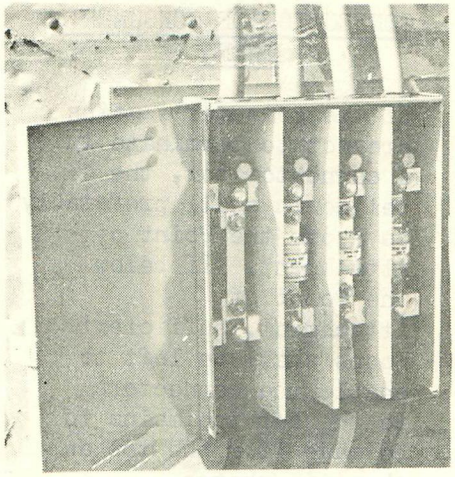
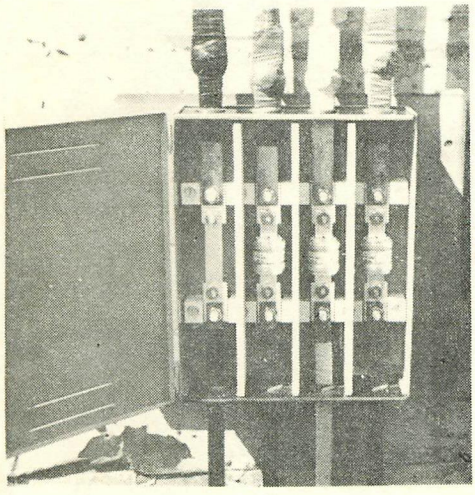


D.



E.

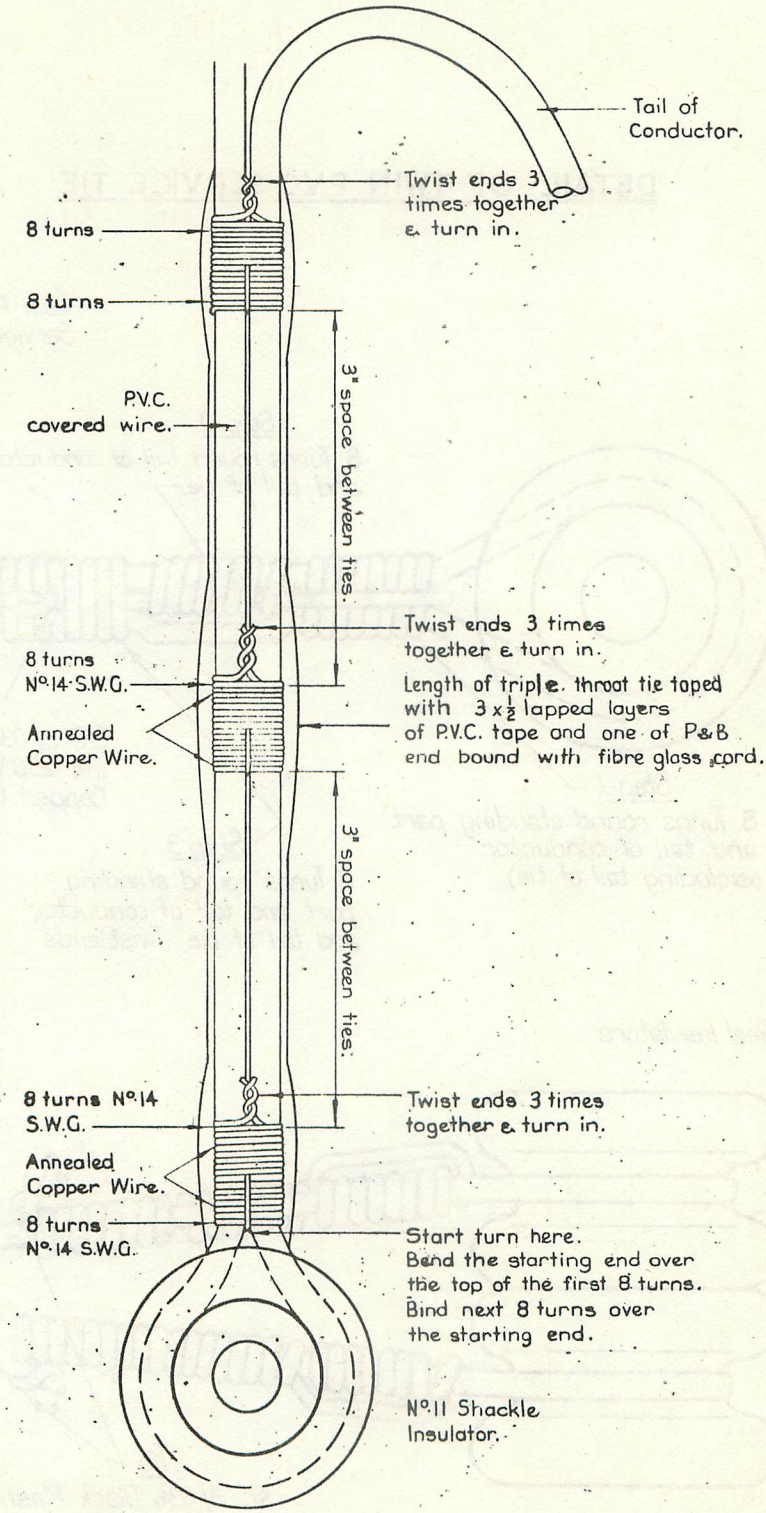
A. 300 Amp Service Cabinet containing fuses and neutral link.

B. Phase Barriers removed. Half Insulating Barrier removed top and bottom to show grommets.

C. Insulating Barriers replaced.

D. Phase Barriers replaced.

E. 400 Amp Service - Cables larger than 0.3 sq. in. showing copper bars connected to consumers' mains. Bars are connected and insulated by Contractor.


Tail of Conductor.
Twist ends 3 times together & turn in.
8 turns
8 turns
P.V.C. covered wire.
3" space between ties.
Twist ends 3 times together & turn in.
8 turns No.14 S.W.G.
Annealed Copper Wire.
Length of triple throat tie taped with 3 x ½ lapped layers of P.V.C. tape and one of P&B end bound with fibre glass cord.
3" space between ties.
8 turns No.14 S.W.G.
Twist ends 3 times together & turn in.
Annealed Copper Wire.
8 turns No.14 S.W.G.
Start turn here. Bend the starting end over the top of the first 8 turns. Bind next 8 turns over the starting end.
No.11 Shackle Insulator.

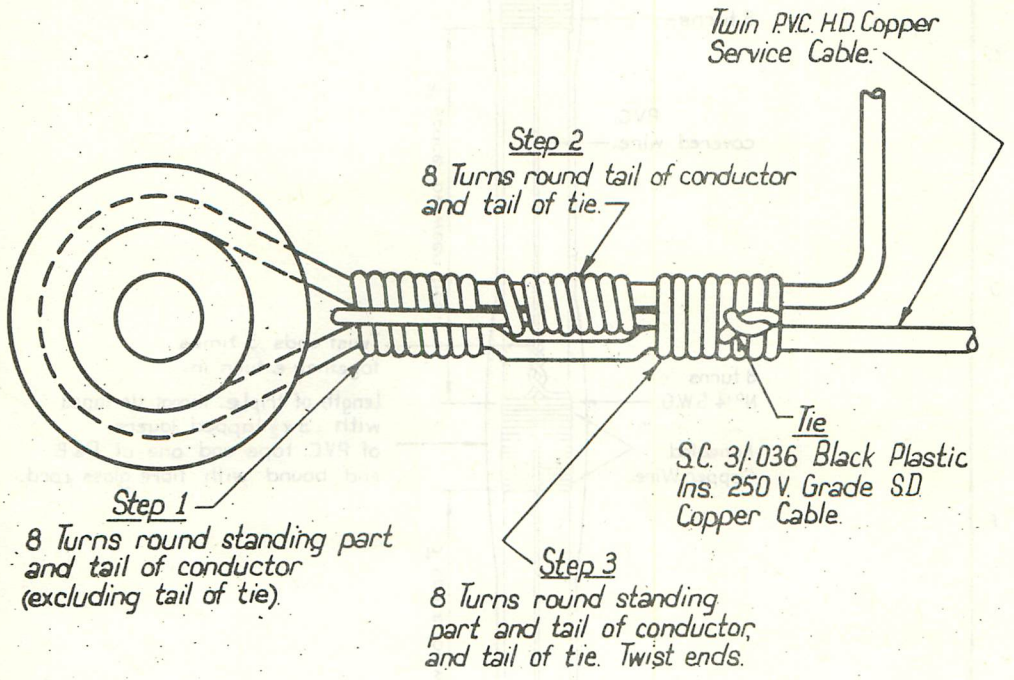
HARD DRAWN COPPER CABLE

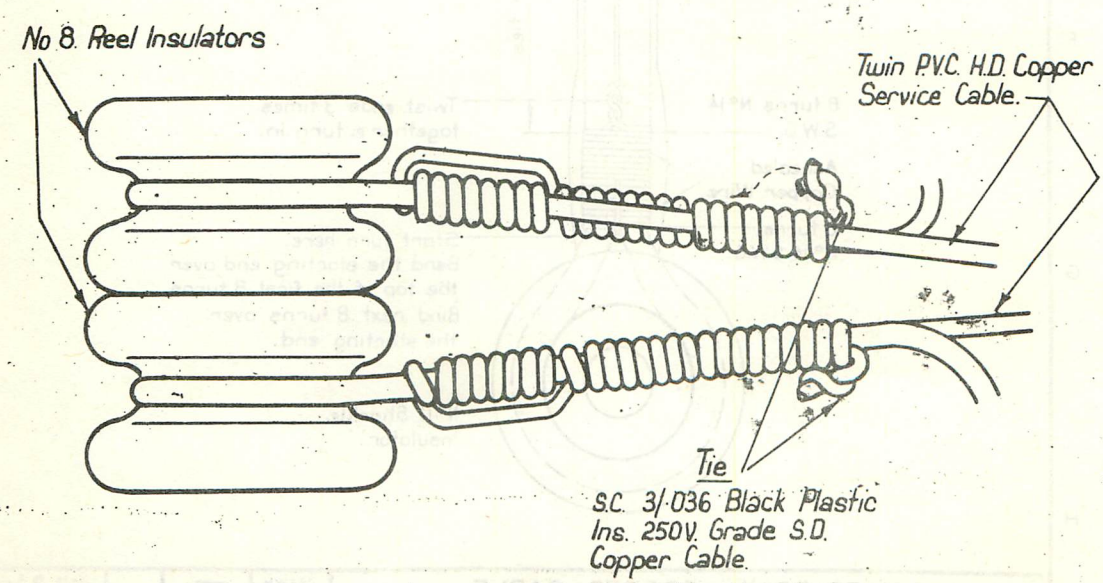
SINGLE CORE SERVICE TERMINATIONS

19/·064, 19/·083 TRIPLE SERVED THROAT TIE - THREE TWISTS

DRAWN	—		DATE 23·5·67
SUP. E			
M.E.			D32638E

DETAIL OF TWIN P.V.C. SERVICE TIE


Twin P.V.C. H.D. Copper Service Cable.
Step 2
8 Turns round tail of conductor and tail of tie.
Tie
S.C. 3/.036 Black Plastic Ins. 250 V. Grade S.D. Copper Cable.
Step 1
8 Turns round standing part and tail of conductor (excluding tail of tie).
Step 3
8 Turns round standing part and tail of conductor, and tail of tie. Twist ends.

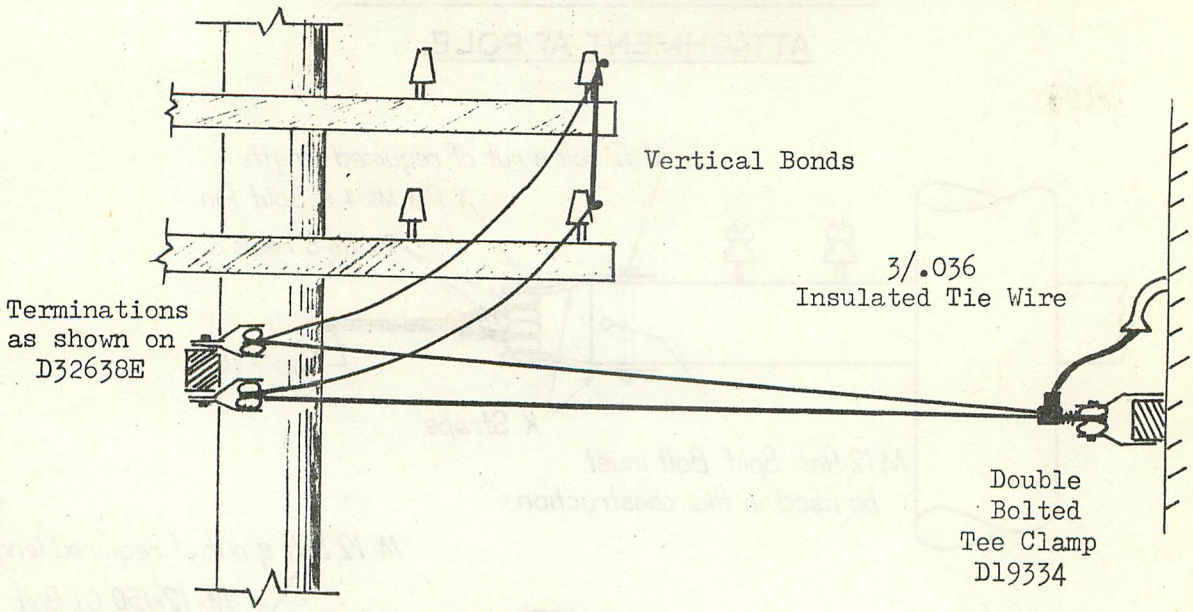


M6481P/

3·10·64 J.S.

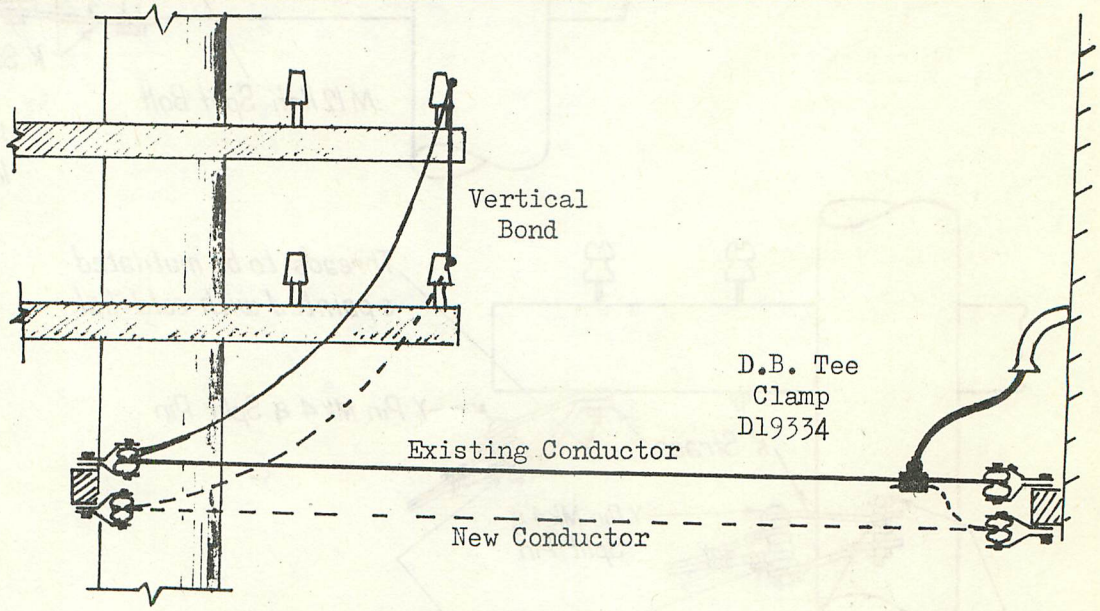
STANDARD CONSTRUCTION FOR HEAVY INDUSTRIAL SERVICES

300/400 Amp. 1 Phase Only Shown



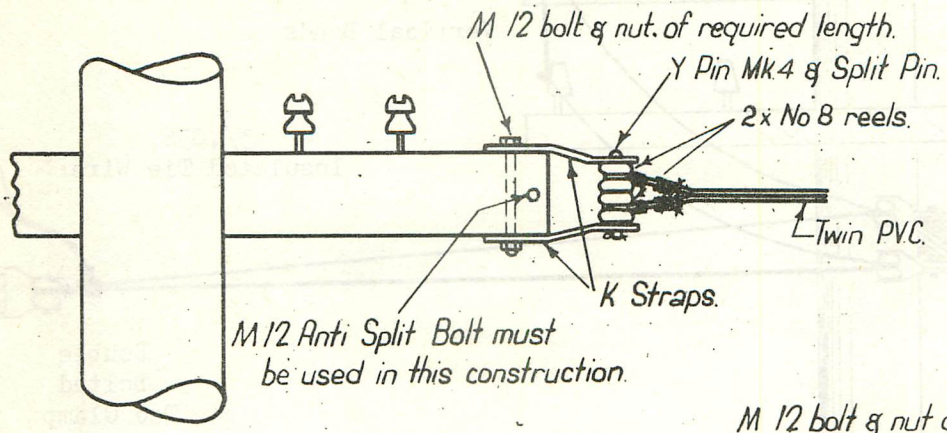
NOTE: VERTICAL SERVICE ARM CAN BE USED.

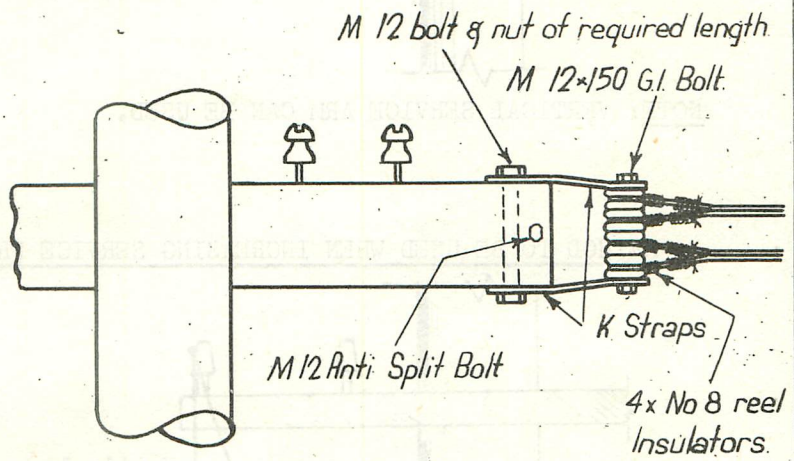
METHOD TO BE USED WHEN INCREASING SERVICE FROM 200 TO 300 OR 400 AMPS.

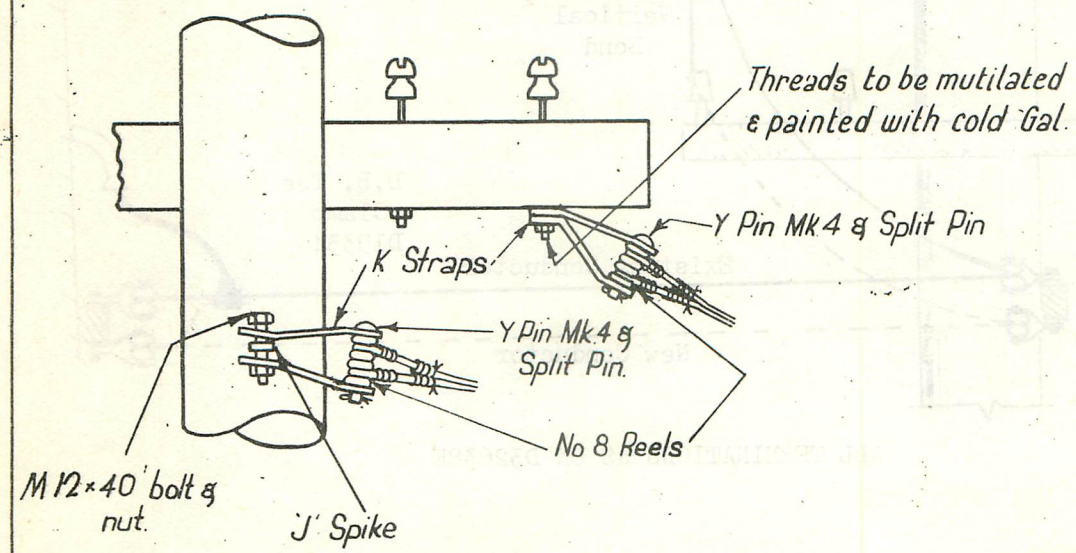


ALL TERMINATIONS AS ON D32638E

STANDARD TWIN P.V.C. SERVICE ATTACHMENT AT POLE.


M 12 bolt & nut. of required length.
Y Pin Mk 4 & Split Pin.
2 x No 8 reels.
Twin P.V.C.
K Straps.
M 12 Anti Split Bolt must be used in this construction.




Threads to be mutilated & painted with cold Gal.
Y Pin Mk 4 & Split Pin
K Straps
Y Pin Mk 4 & Split Pin.
No 8 Reels
M 12 x 40 bolt & nut.
'J' Spike

M6463

M6463 P/1

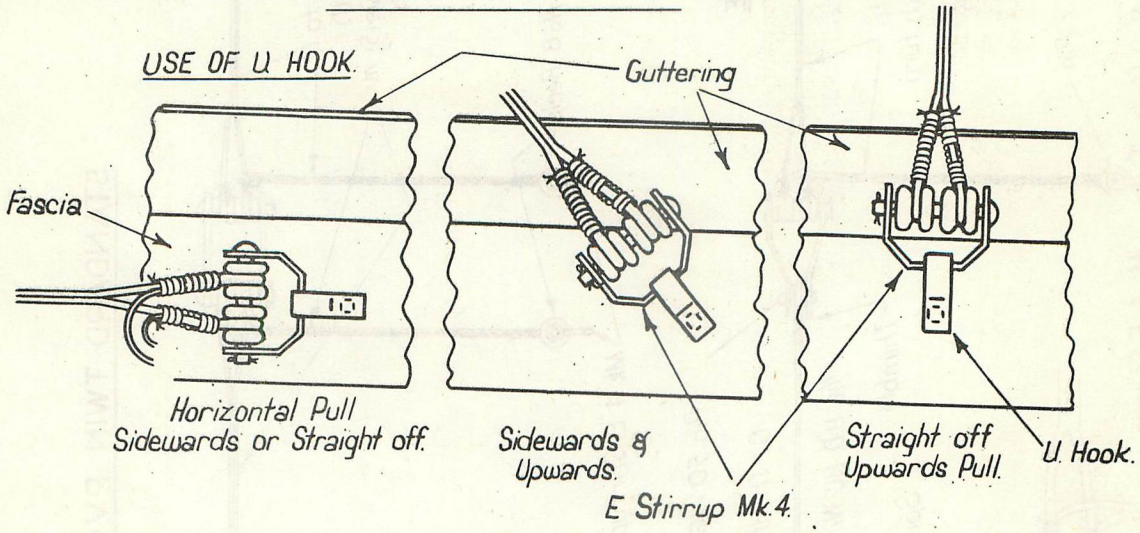
1·4·69 J.S.

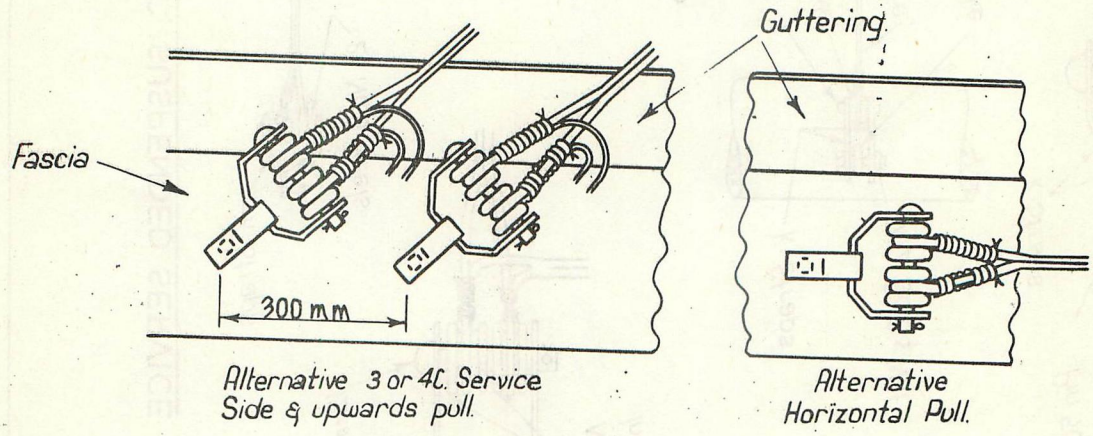
STANDARD TWIN P.V.C. SERVICE
POINT OF ATTACHMENT AT HOUSE

The U Hook and F Clip may be utilized at the P of A for an upwards downwards or sidewards pull, by varying the mounting angle as indicated in sketches below.

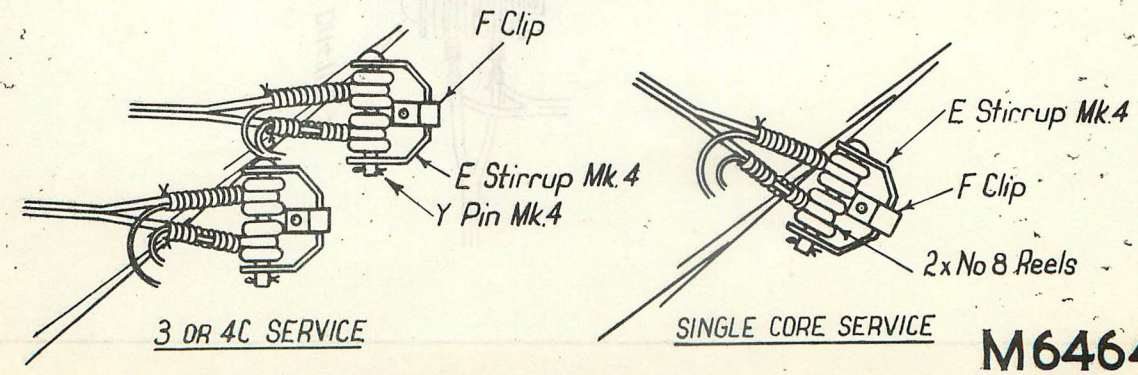
The 'E' fitting must always be free to follow the direction of pull.

USE OF U HOOK.





USE OF F CLIP (Note carefully the position of the bolt.)

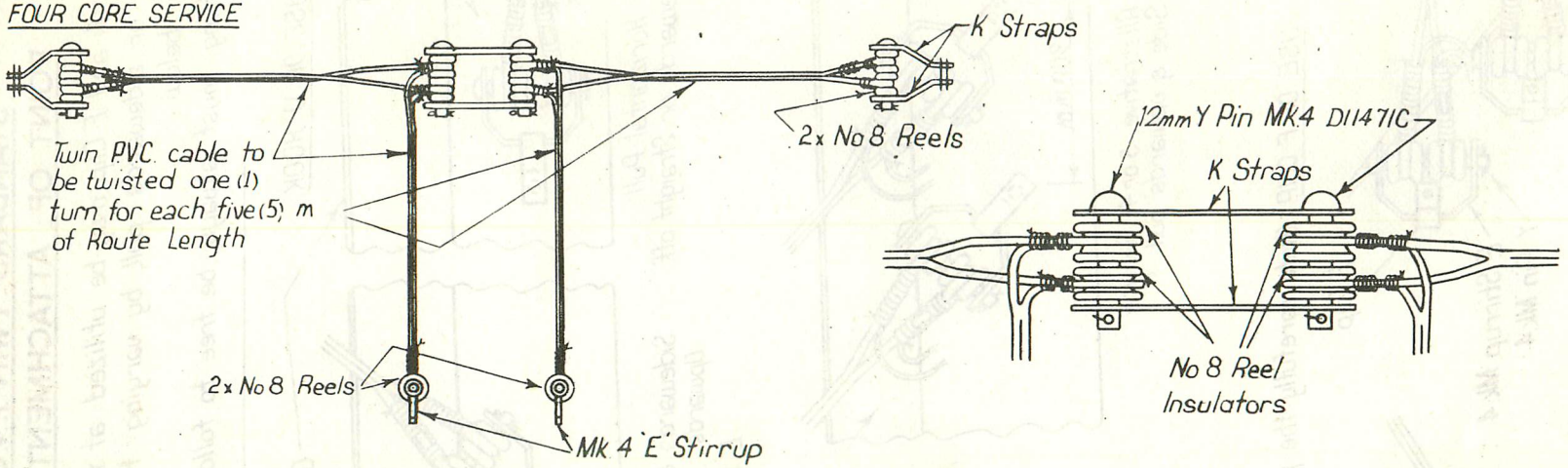


M6464

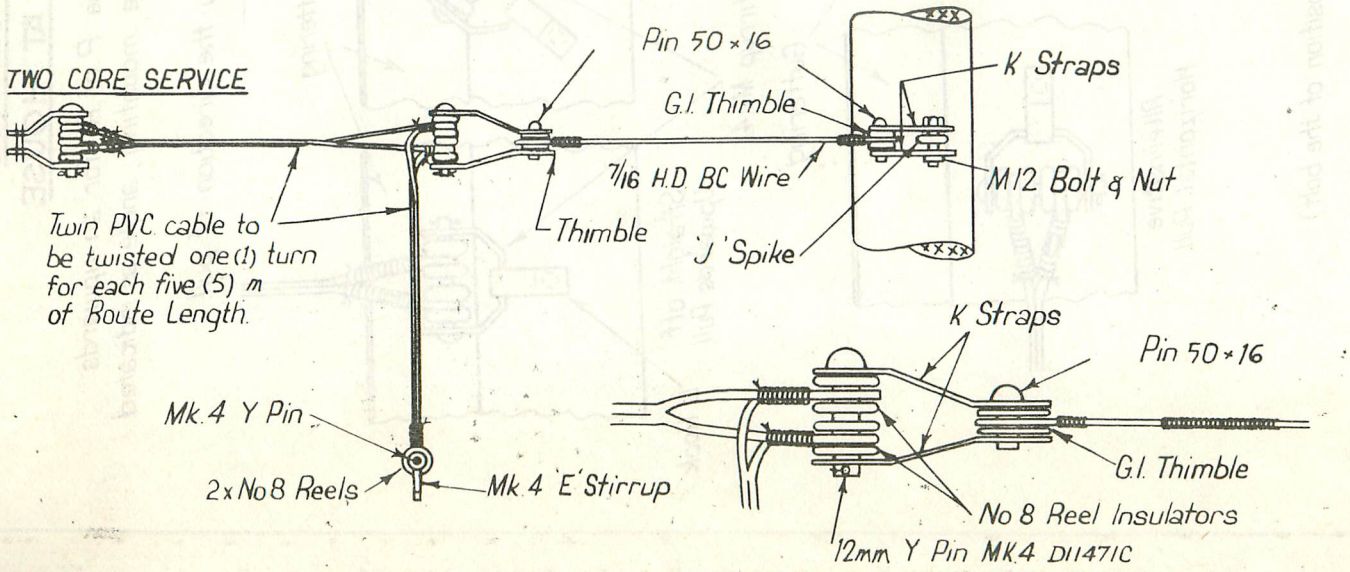
M6464P/
3·10·64 J.S.

STANDARD TWIN P.V.C. SUSPENDED SERVICE

FOUR CORE SERVICE


K Straps
2x No 8 Reels
Twin P.V.C. cable to be twisted one (1) turn for each five (5) m of Route Length
2x No 8 Reels
Mk 4 'E' Stirrup
12mm Y Pin Mk.4 D11471C
K Straps
No 8 Reel Insulators

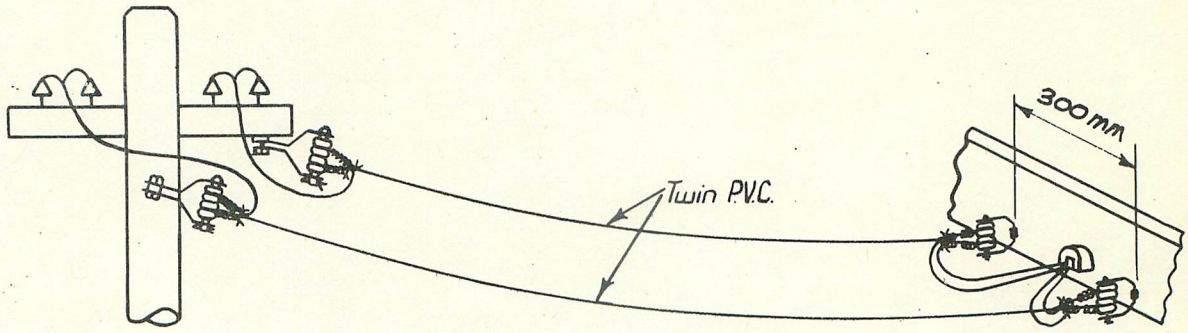
TWO CORE SERVICE


Pin 50 x 16
G.I. Thimble
7/16 H.D. BC Wire
Thimble
'J' Spike
K Straps
M12 Bolt & Nut
Twin P.V.C. cable to be twisted one (1) turn for each five (5) m of Route Length.
Mk.4 Y Pin
2x No 8 Reels
Mk 4 'E' Stirrup
K Straps
Pin 50 x 16
G.I. Thimble
No 8 Reel Insulators
12mm Y Pin Mk.4 D11471C

M6462P/
3·10·64 JS

STANDARD TWIN P.V.C. SERVICE
GENERAL ARRANGEMENT

3 PHASE SERVICES



Notes

1. Attachments at poles shown are suggested, but may be varied in practice. The use of 4 insulators on one bolt should be avoided where possible.
2. Attachments at pole & house are shown on M6463P, M6464P.
3. Twin cables should not be strapped together.
4. Details of twin P.V.C. service tie are shown on D34645E (D.C.E.)

DETAILS OF SAG ATTACHING CABLES HAND-TIGHT

SPAN	SAG
30m	1·0m
40m	1·3m
50m	2·0m

M6461

M6461P/1
3·10·64 J.S.

SECTION 3 PROCEDURE FOR THE INSTALLATION OF A NEW SERVICE

(This complete procedure appertains to a 4-core service. Certain of its steps and operations obviously do not apply to a 3-core, or a 2-core service).

Installation Procedure

(1) Check that the service conditions (point of attachment and service board positions, etc.) are in accordance with the Service Marker's sketch.

(2) Determine the phase(s) to which the service will be connected.

Note:- To achieve this the linesman will check existing phase connections of each service on the pole involved with a view to obtaining a balance of connections over the three phases. Where a balance at that pole is not possible, he will check at the poles on each side of it and select the phase(s) for the new connection which, with the new connection, most nearly balance numerically the total number of connections to each phase at the three poles inspected. If the pole concerned is an open point, then the linesman will consider the two nearest poles on the same set of distributors to which the service is to be connected.

(3) Erect the service board complete with neutral link and service fuse boxes.

(4) Cut to suitable length, bare, bind and temporarily insulate the ends of the consumer's mains at the service board position.

(5) Install the service lines and connect at the point of attachment.

(6) Identify the L.V. neutral distributor at the pole, with L.V. test lamps. Then connect the neutral service line to the neutral distributor.

(7) Check between the proposed "A" phase service line and the "A" phase L.V. distributor to which it is to be connected for a NO GLOW result in the test lamps. Prove test lamps. Then connect "A" phase service line to "A" phase distributor.

Note:- Should a glow in the test lamps result from this test, the linesman will not connect the service line and will promptly disconnect the service entirely. He will then immediately report the situation to his supervisor who will instantly notify the Mains Depot concerned.

(8) Install a temporary earth stake (completely insulated above ground level) with one bare end of an insulated conductor connected to the stake and its other bare end safely secured, adjacent to the service board.

(9) Identify "A" phase consumer's main at the service board position by testing all consumer's mains to the temporary earthing conductor. A HALF GLOW in the test lamps should result from one wire only. This wire will be immediately connected to "A" phase service fuse box.

(10) Identify the neutral consumer's main at the service board by testing from "A" phase to the remaining three wires with L.V. test lamps. A HALF GLOW should result from one only of these wires, which will then be immediately connected to the S.C.C. neutral link.

(11) Connect "B" phase service line, in the manner described in step 7. (The test, of course, will be between the service line and "B" phase distributor).

(12) Identify "B" phase consumer's main at the service board position by testing the remaining two wires in the manner described in step 9, and connect it to "B" phase service fuse box. Then connect the remaining wire to "C" phase service fuse box.

(13) Connect "C" phase service line, in the manner described in step 7. (The test, of course, will be between the service line and "C" phase distributor).

(14) At the service board position, apply with proven L.V. test lamps the FULL STANDARD TEST, as follows:-

Neutral to Earth	No Glow
"A" Phase to Earth	Half Glow
"B" Phase to Earth	Half Glow
"C" Phase to Earth	Half Glow
Neutral to "A" Phase	Half Glow
Neutral to "B" Phase	Half Glow
Neutral to "C" Phase	Half Glow
"A" Phase to "B" Phase	Full Glow
"A" Phase to "C" Phase	Full Glow
"B" Phase to "C" Phase	Full Glow.

(15) Leave the service fuses for later insertion by the Installation Inspector, and seal the necessary equipment at the service board position.

(16) Remove the temporary earth stake and lead.

(17) Complete the required details on the reverse side of the Service Marker's sketch.

(18) Enter the necessary information, relating to the particular service, on the Bulk Service Material Ordering Form (Bulk Supply Form).

SECTION 4

PROCEDURE FOR DISCONNECTING AND RECONNECTING AN EXISTING SERVICE

(This complete procedure appertains to a 4-core service. Certain of its steps and operations obviously do not apply to a 3-core, or a 2-core service).

Disconnection Procedure

1. Notify the customer.

   Note: Except in an emergency, supply must not be intentionally disconnected without giving at least 48 hours' notice to the customer concerned. This may be done by verbal discussion with the customer in which case one copy of the form NM1290 will also be handed to the customer. However, if the customer is not on the premises at the time of the call, one form NM1290, suitably filled in, must be left in the letter box and also one form NM1290 placed under the entrance door.

   The above period of time may be relaxed in cases where all the affected customers can be notified personally and where no objections to the time of the proposed disconnection are raised.

2. Install a temporary earth stake (completely insulated above ground level) with one bare end of an insulated conductor connected to the stake and its other bare and safely secured, adjacent to the service board.

3. BEFORE drawing the service fuses, identify and mark the position of the neutral conductor and check for correct polarity of the service at the service board position, by testing with L.V. test lamps, to the temporary earth stake installation.

   Note: If the polarity is not correct, the linesman will entirely disconnect the service immediately, notify the customer and his supervisor who will instantly arrange, via the Mains Depot concerned, for an Emergency Service Officer to visit the job. The Linesman will remain on the job to assist the Emergency Service Officer.

4. Draw the service fuses.

5. Disconnect "A" phase service line at the pole or point of attachment, as applicable to the particular job. Mark and tie back the disconnected service tap or tail.

   Note: Marking of a wire is performed only as a very minute supplementary guide associated with the use of proven L.V. test lamps which provide the only positive identification as to whether a low voltage conductor is connected ("alive") or disconnected ("dead"). Marking will never be relied upon for such identification.

6. Identify the disconnected "A" phase conductor, and mark same, at the service board position.

7. Repeat steps 5 and 6 for the remaining phases of the service.

8. Disconnect the neutral service line last of all, using the procedure described in step 5.

Reconnection Procedure

1. Ensure that the service fuses are drawn and the proposed consumer's mains neutral is connected to the S.C.C. neutral link.

   Note: When the connection is to be carried out at the pole, also ensure that all consumer's mains are connected to the service lines.

2. Except in the case where the customer's main earth is directly connected to the S.C.C. neutral link, temporarily connect the S.C.C. neutral link to the customer's earth wire adjacent to the service board by means of an insulated conductor. If there is no customer's earth wire near the service board, connect the S.C.C. neutral link to a temporary earth stake (completely insulated above ground level) by means of an insulated conductor.

   Note: A temporary earthing conductor must not be connected to a water or gas piping system.

3. Test at the pole or point of attachment (as applicable to the job) with proven L.V. test lamps between a known live phase and each conductor which is to be connected.

4. A half glow in the test lamps should result on one such conductor only, and this will identify it as the one to be immediately connected to the neutral conductor.

Note: If any other result is obtained the service must be left entirely disconnected and the linesman will immediately notify the customer and his supervisor who will instantly arrange, via the Mains Depot concerned, for an Emergency Service Officer to attend the job. The linesman will remain on the job to assist the Emergency Service Officer.

5. At the pole or point of attachment (as applicable to the job), check between the proposed "A" phase conductor to be connected and the live "A" phase to which it is to be connected for a NO GLOW result in the test lamps. Prove test lamps. Then connect "A" phase.

Note: Should a glow in the test lamps result from this test, the linesman will not connect the conductor and will promptly disconnect the service entirely. He will then immediately notify the customer and report the situation to his supervisor who will instantly arrange via the Mains Depot concerned, for an Emergency Service Officer to attend the job. The linesman will remain on the job to assist the Emergency Service Officer.

6. At the service board identify the energised "A" phase consumer's main and ensure that it is in the same position as before disconnection.

7. Repeat steps 5 and 6 for the remaining phases.

8. Disconnect the temporary earthing (if installed in step 2) from the S.C.C. neutral link.

9. Carry out the FULL STANDARD TEST with L.V. test lamps at the service board before inserting the service fuses, (using a temporary earth stake installation as described in step 2), via.

Neutral to Earth for No Glow.
Phases to Earth for Half Glow.
Phases to Neutral for Half Glow.
(Phase to Phase (A to B; A to C; B to C)) for Full Glow.

10. Test the service fuses and insert same. Further testing at meter and time switch terminals will then be carried out, when required.

11. Test between the adjacent customer's earth wire (if any) and the temporary earth stake installation for NO GLOW in the test lamps. Prove the test lamps.

12. Wherever practicable, test between the customer's neutral link and the temporary earth stake installation for NO GLOW in the test lamps. Prove the test lamps.

Note on steps 11 and 12:- If, in either test, any result other than NO GLOW is obtained, immediately act in accordance with the Note in step 5.

13. Where necessary, check meter disc(s) for correct direction of rotation.

14. Check with the customer (if on premises) for satisfactory supply.

15. Seal up all necessary equipment.

16. Remove the temporary earth stake and lead.

SPECIAL PRECAUTIONS TO BE OBSERVED RELATIVE TO SERVICE RECONNECTION

1. (a) Where reconnection of a service has been preceded by the disconnection of any customer's wiring from the terminal(s) of any S.C.C. meter(s), connector block(s) or time switch, all customer's wiring will be left disconnected,

and

(b) The linesman will carry out all tests in reconnection procedure (except steps 12, 13 and 14) and restore supply to the line side terminals only of the meter(s) and time switch (if any). Seal necessary equipment,

then,

(c) The linesman will immediately notify his supervisor who will instantly arrange, via the Mains Depot concerned, for an Emergency Service Officer to finally restore and check supply to the customer.

2. (a) Where it has not been possible, BEFORE disconnection, to positively identify the neutral conductor and check for

correct polarity of the service at the service board position,

or

(b) Where, under any circumstances, it is found to be impossible to carry out the necessary procedure for the reconnection of a service,

then

The linesman will leave such service entirely disconnected, seal all necessary equipment, leave written notification for the customer (if not at home) to contact, upon return, the S.C.C. Emergency Service; and immediately notify his supervisor who will instantly furnish the Emergency Service Section with full details of the particular situation.

SECTION 5

TEMPORARY SUPPLY (DUE TO FAILURE OF CONSUMER'S MAINS)

Service fuses to be drawn and supply to be disconnected at P. of A. Customer handed NM 1330 card if service conditions are satisfactory.

Temporary Supply is Requested

(1) Owner or tenant only to make request - not contractor.

(2) L/M completes NM 1405 form which is signed by the customer.

(3) Charge for temporary supply up to 70 amps - $6.00. Above 70 amps actual cost.

(4) When service conditions are considered unsatisfactory, temporary supply is provided without collecting signed NM 1405 form. Occupant instructed not to have consumer's mains renewed until advised by Council whether any alterations to the service are necessary. L/M is to report this to the foreman. Leave ME 145A form with customer. Leave a second ME 145A form attached to consumer's mains at board addressed to the electrical contractor.

(5) Unsatisfactory Conditions are:-

(a) Insufficient clearance of service wires from around dwarf walls, building, windows etc. (See clearances.)

(b) P. of A. inaccessible, except by walking over rooftiles etc.

(c) Enclosed or inaccessible meter position.

(d) Unsuitable service board position. i.e. dangerous to replace fuses or where service fittingsare likely to be damaged.

(e) P. of A. too high or too low. Min. 9', Max. 22'.

NOTE: Break fuses in consumer's mains are not considered unsatisfactory service conditions, nor is a service classified as inaccessible if it is located on a verandah enclosed solely by a small dwarf wall.

(6) If Em.S.O. collects signed NM 1405 form but cannot give temporary supply himself, the form will be sealed in the right hand fuse box. When the L/M collects the undertaking, he will see that the correct charge is shown and if signature is not clear, the name of the person should be printed underneath.

Method of Giving Temporary Supply

(1) Minimum size of wire is 7/.036 insulated.

(2) Temporary wiring should leave the old wiring clear for contractor's work.

(3) Temporary wiring to be installed out of reach and secured. If wiring must be in reach, it must be covered with rubber or plastic tubing - double insulated.

(4) Care should be taken that the neutral is connected in the correct position. Rotation of 3 phase motors should be checked.

(5) Do not forget to disconnect old consumer's mains from cut outs and P. of A.

Additional Forms Associated with Service Work

(1) Report of Failure of O.H. Construction

(2) Report on Damage to Construction by Third Party

(3) Report on Twin P.V.C. Service Cable Failure

NOTE: If wires are brought down by a crane or high load, height of cables above ground must be correctly ascertained and recorded.

(4) Undertaking Form (Gen 21)

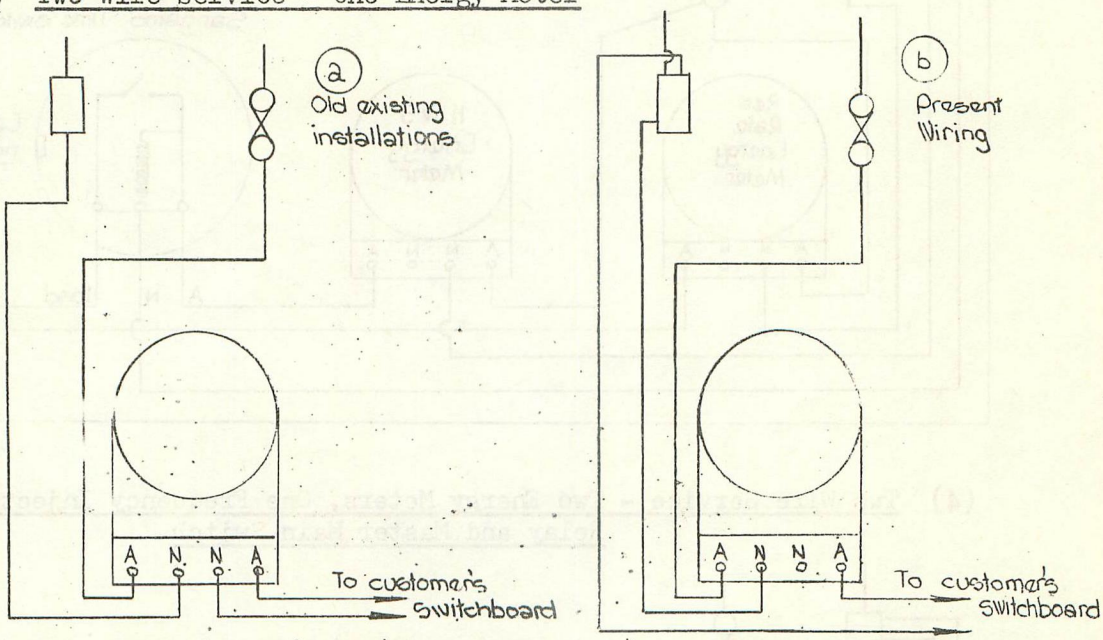
To be signed by customer, promising to pay cost of S.C.C. labour, material etc. Signature must be clear. e.g. (a) Rubbering L.V. mains for scaffolding. (b) Dismantling and replacing mains for tree trimming at customer's request.

SECTION 6

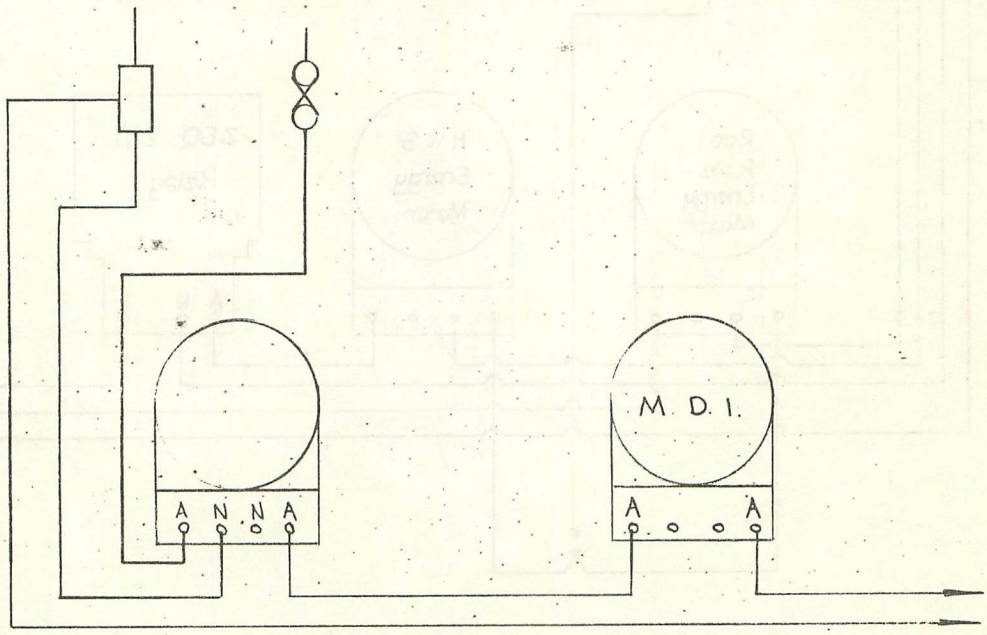
WIRING DIAGRAMS

The diagrams below show arrangements of service board wiring on common types of installations.

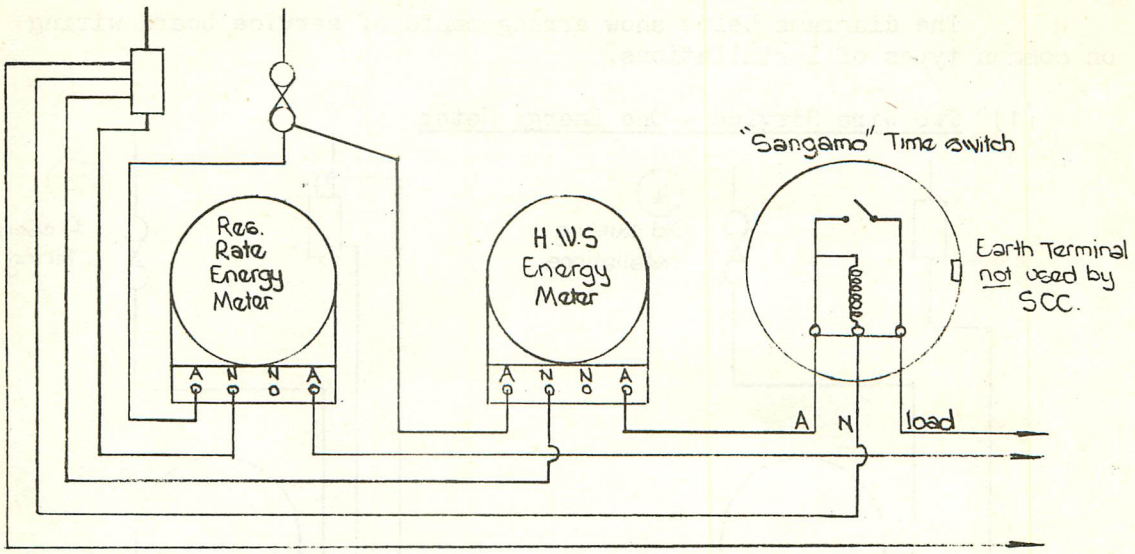
(1) Two Wire Service - One Energy Meter



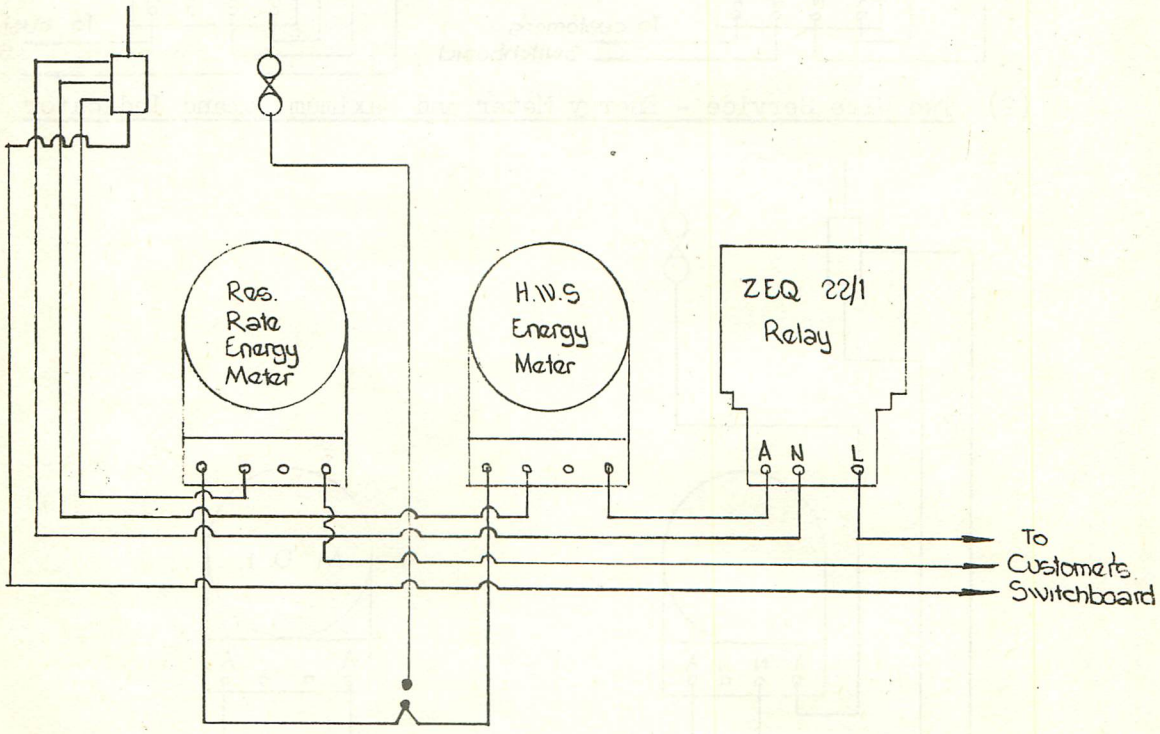
(2) Two Wire Service - Energy Meter and Maximum Demand Indicator



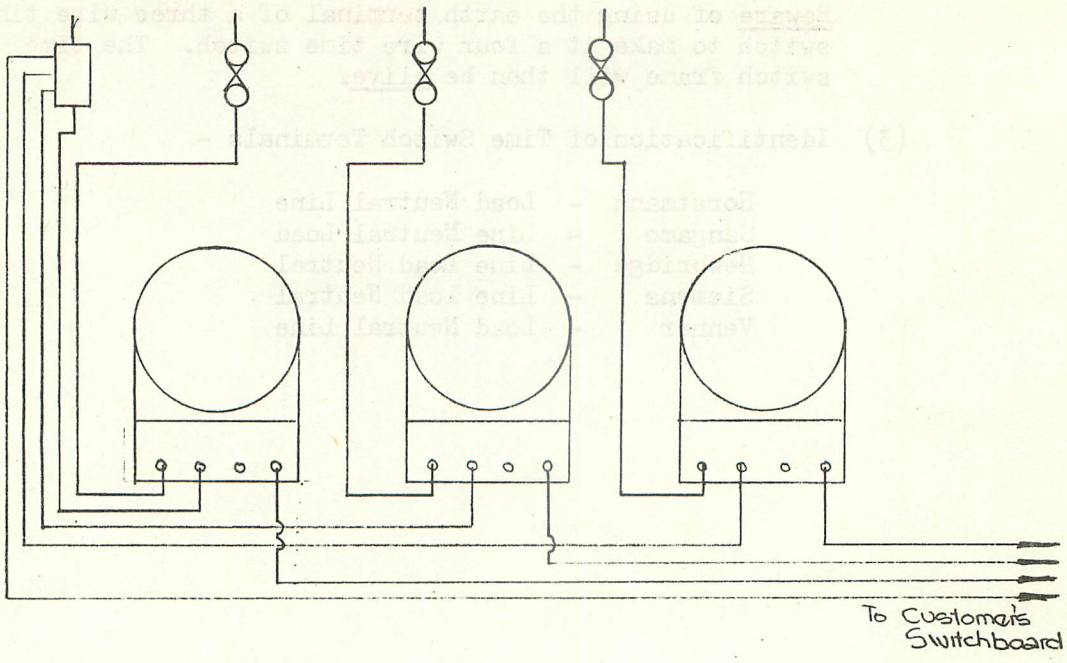
(3) Two Wire Service - Two Energy Meters One Time Switch



(4) Two Wire Service - Two Energy Meters, One Frequency Injection Relay and Master Main Switch



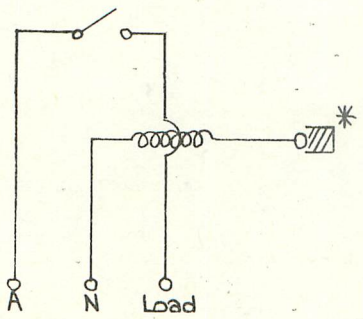
(5) Four Wire Service - Three Energy Meters



NOTES:

(1) Customer's Main Switch is installed on load side of meters. Customer's Master Switch is installed on line side of meters. Master Switch is always sealed by S.C.C.

(2) Four Wire 'Sangamo' Time Switch



(i) Where customer has a Master Switch the terminal indicated* in sketch is energised by a 3/.036 wire connected to load side of S.C.C. fuse, thus ensuring supply to the clock when the Master Switch is open.

(ii) Where customer has a Main Switch only, the terminal indicated* in sketch is energised by a 3/.036 wire connected to the line active terminal of the time switch.

Beware of using the earth terminal of a three wire time switch to make it a four wire time switch. The time switch frame will then be alive.

(3) Identification of Time Switch Terminals -

Horstmann	-	Load Neutral Line
Sangamo	-	Line Neutral Load
Newbridge	-	Line Load Neutral
Siemens	-	Line Load Neutral
Venner	-	Load Neutral Line

SECTION 7

FREQUENCY INJECTION LOAD CONTROL RELAYS

To provide better control of "off-peak" loads, Council is installing an audio frequency injection remote control system which uses receiving relays on customers' switchboards instead of time switches.

The programme of replacing time switches with relays, which began in the Turramurra Zone, will spread to all other areas with substantial "off-peak" loading. Time switches will be retained in predominantly industrial areas.

The relays are mainly of two types:-

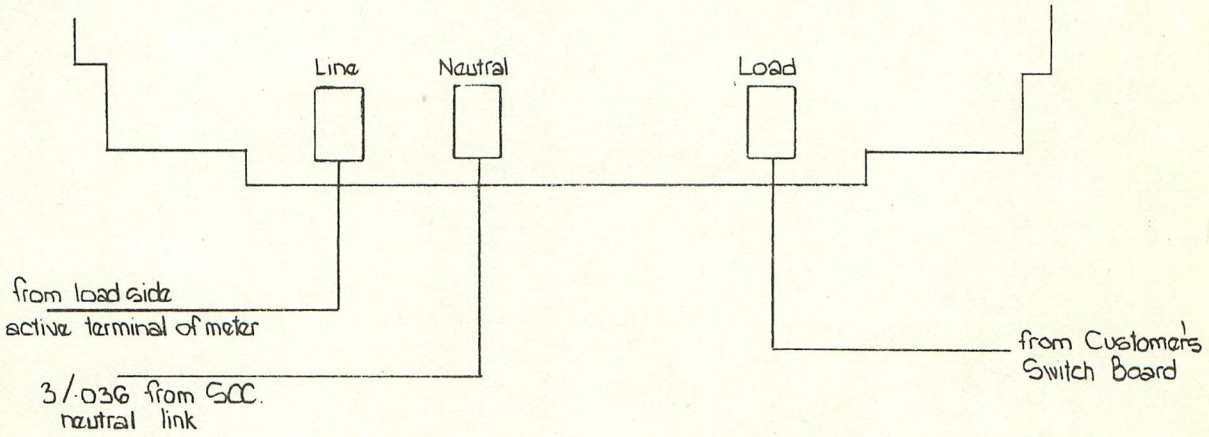
(1) Type ZEQ22/1 having three terminals and one load control switch.

(2) Type ZE22/3 having seven terminals and three load control switches.

Linesmen may encounter these relays when required to replace and/or relocate meter boards. Only ZEQ22/1 (three terminal) or other 3 terminal relays with which the linesman is familiar will be moved and reconnected by him. If a Linesman encounters a ZE22/3 (seven terminal) relay or unfamiliar relay which is to be moved, he will inform his supervisor who will arrange via the O.H. depot concerned for a Connecting Officer to work in conjunction on the job.

Installation

The ZEQ22/1 relay will be mounted with three 5/8" x 8 gauge R.H. wood screws. Terminals on this relay are as shown below.



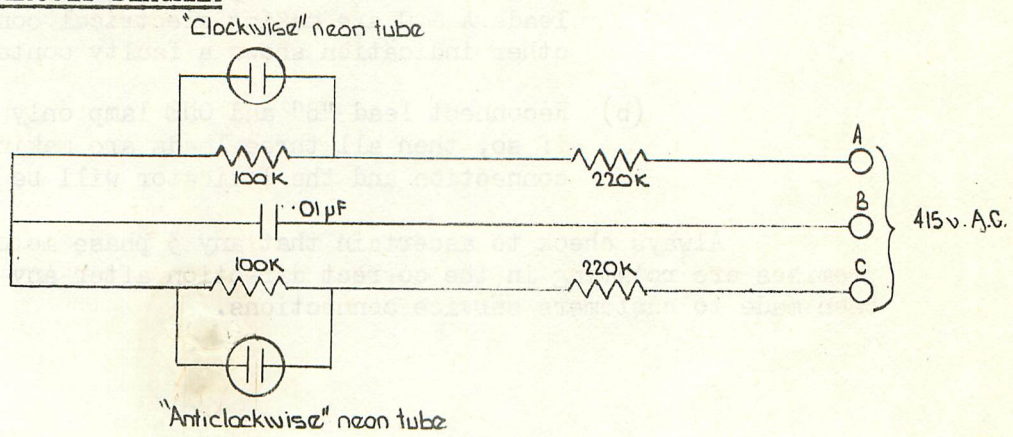
Linesmen shall make and check connections to the line and neutral terminals but not to the load terminal. In accordance with normal practice the Linesman will notify his supervisor so that the Foreman can arrange for an Emergency Service Officer to attend the job to check and restore supply to the customer.

SECTION 8

PHASE SEQUENCE INDICATOR

A miniature type phase sequence indicator has recently been issued to district depots for the purpose of determining the phase sequence of a three phase supply. The components as shown in circuit diagram are connected and then cast in an epoxy resin mould.

CIRCUIT DIAGRAM



Two instruments have been made, one for use of 415V and one for use on 110V. To distinguish between the two models, the label is marked at its operating voltage and the 415V instrument has a white traffolyte label with black leads and connections and the 110V instrument has a red label with red leads and connections.

To obtain the phase sequence of a three phase supply, connect leads marked A, B & C in that order from left to right and an indication will be given by either the clockwise or anticlockwise lamp glowing.

An incorrect indication will be given if:-

(a) A lack of supply exists on any one of the three phases.

(b) The instrument leads are connected with a cross in them.

(c) An open circuit exists in an instrument lead or a bad connection is being made between clip and terminal.

To ensure that these conditions do not arise the following procedure must be carried out.

(1) Carry out the full standard test with normal test lamps to ensure that all 3 phases are alive.

(2) Make certain that P.S.I. leads are connected A, B and C in that order from left to right.

(3) (a) After connecting leads as in (2) remove lead "B", if both indicator lamps glow (at $\frac{1}{2}$ glow), then leads A & C are making electrical contact. Any other indication shows a faulty contact or lead.

(b) Reconnect lead "B" and ONE lamp only should glow, if so, then all three leads are making an electrical connection and the Indicator will be reading correctly.

Always check to ascertain that any 3 phase motors on customers premises are rotating in the correct direction after any alterations have been made to customers service connections.

SECTION 9 SYSTEMS OF EARTHING

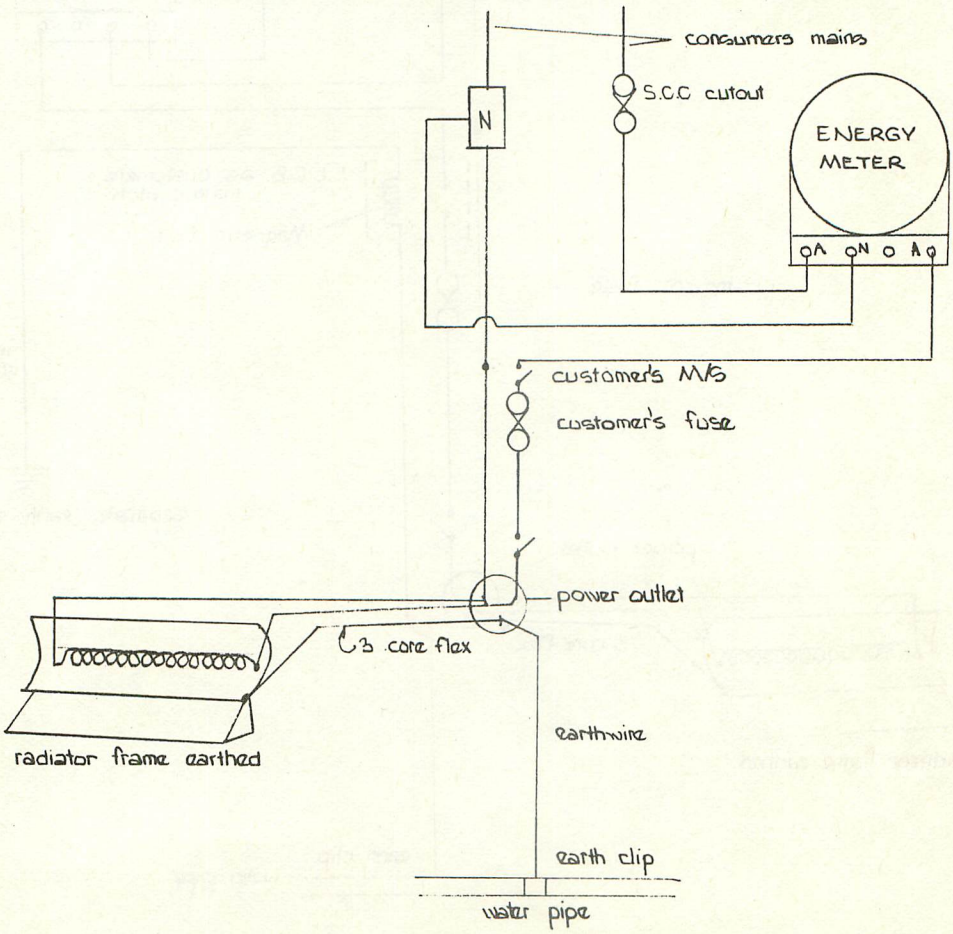
The standard system of earthing for customers in the S.C.C. area is the Multiple Earth Neutral, or M.E.N. system.

Other systems which were previously used and still exist on a large number of installations are the Direct Earth System and the Earth Leakage Circuit Breaker System, E.L.C.B.

(1) Direct Earth System

In this system the earthwire runs from earth electrode or water piping system direct to frames of appliances, conduits, etc. Should an active to frame fault occur a heavy current will flow via the earth to the star point of the transformer supplying the premises and cause the customer's fuse to blow, thus isolating the fault.

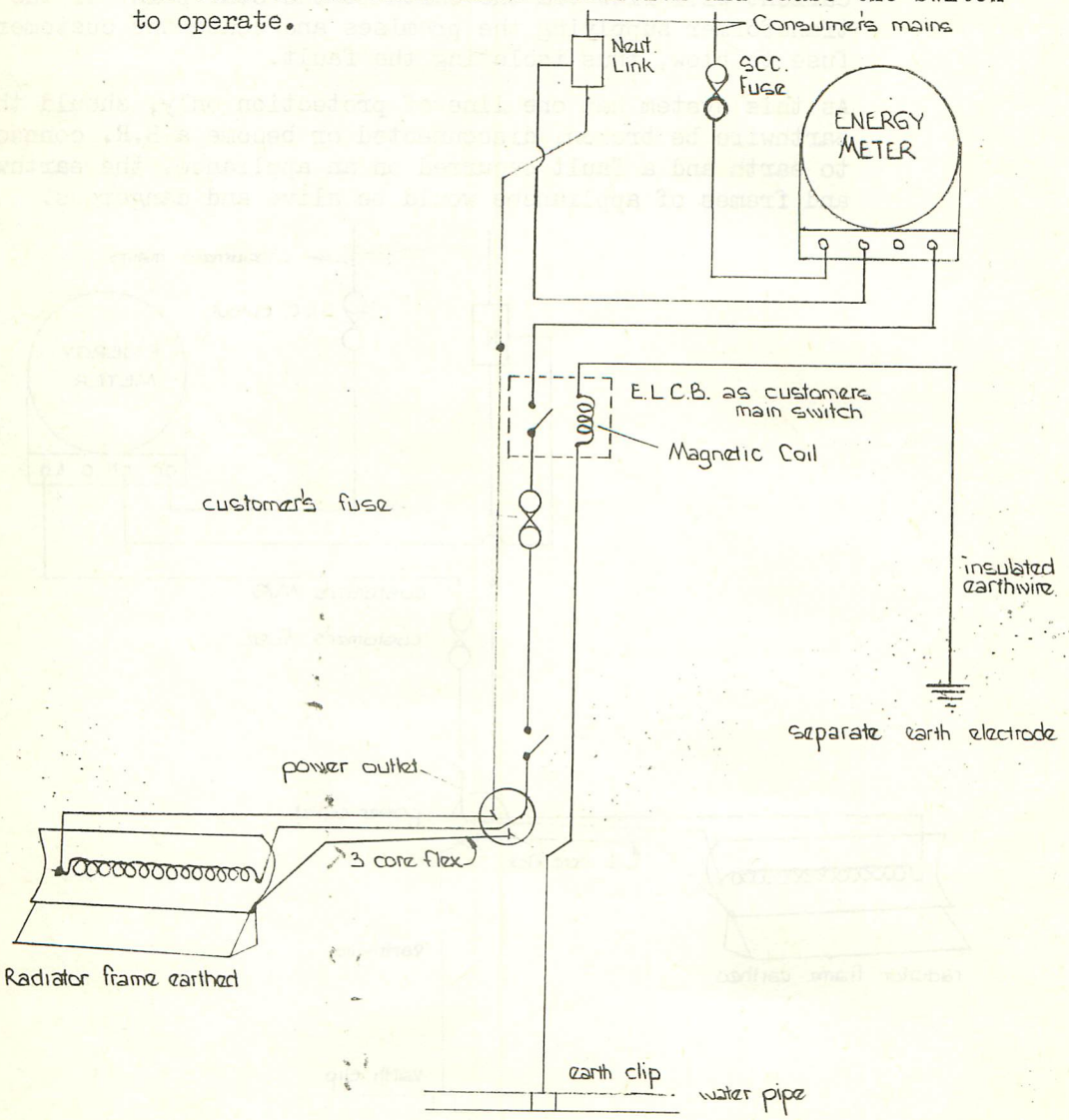
As this system has one line of protection only, should the earthwire be broken, disconnected or become a H.R. connection to earth and a fault occurred on an appliance, the earthwire and frames of appliances would be alive and dangerous.



(2) E.L.C.B. (Earth Leakage Circuit Breaker) System

This system has two lines of protection. The earthwire connected to all power outlets etc. is connected to the water pipe as in the Direct Earth System, it is also connected via a small coil in the main switch and an insulated earthwire to a separate earth electrode. The coil in the main switch is designed to operate and open the switch at extra low voltage.

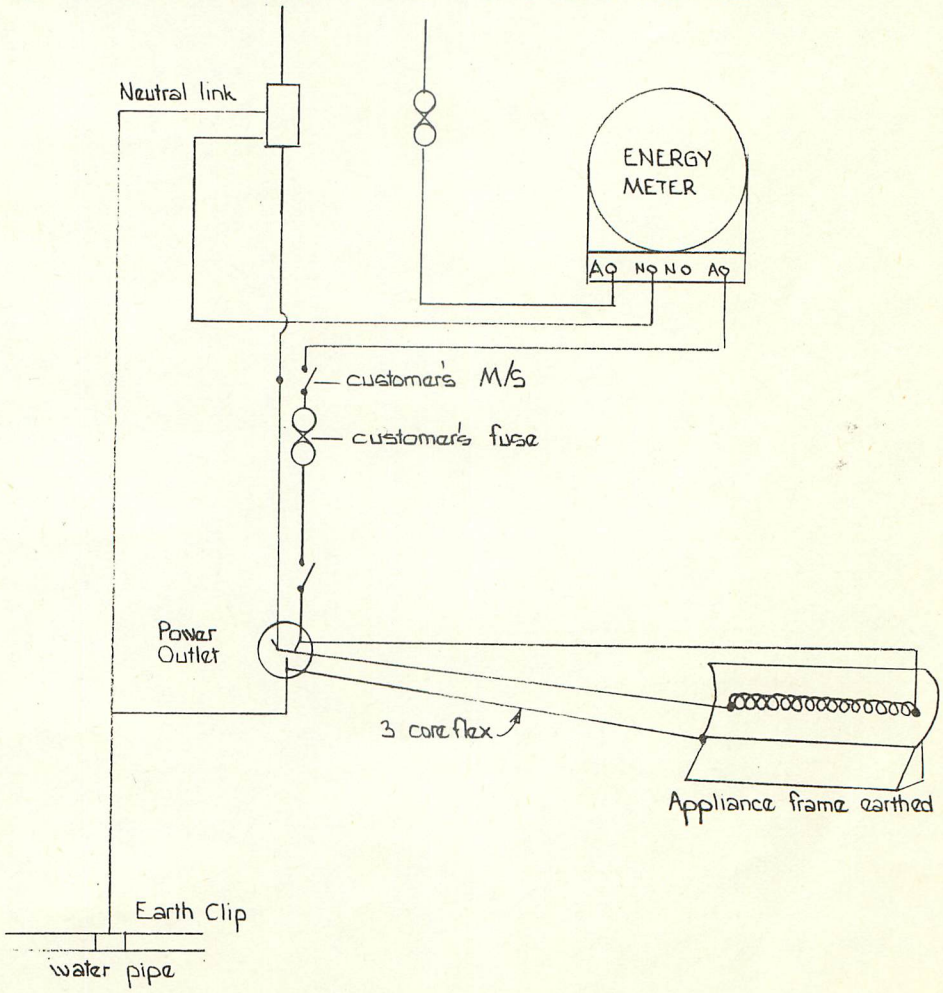
The main disadvantage with this system is that the coil can operate in reverse, if an earth fault occurs in the close vicinity, causing a rise in potential of the ground around the separate electrode, current will flow through the coil to the main earth connection and cause the switch to operate.



(3) M.E.N. (Multiple Earth Neutral) System

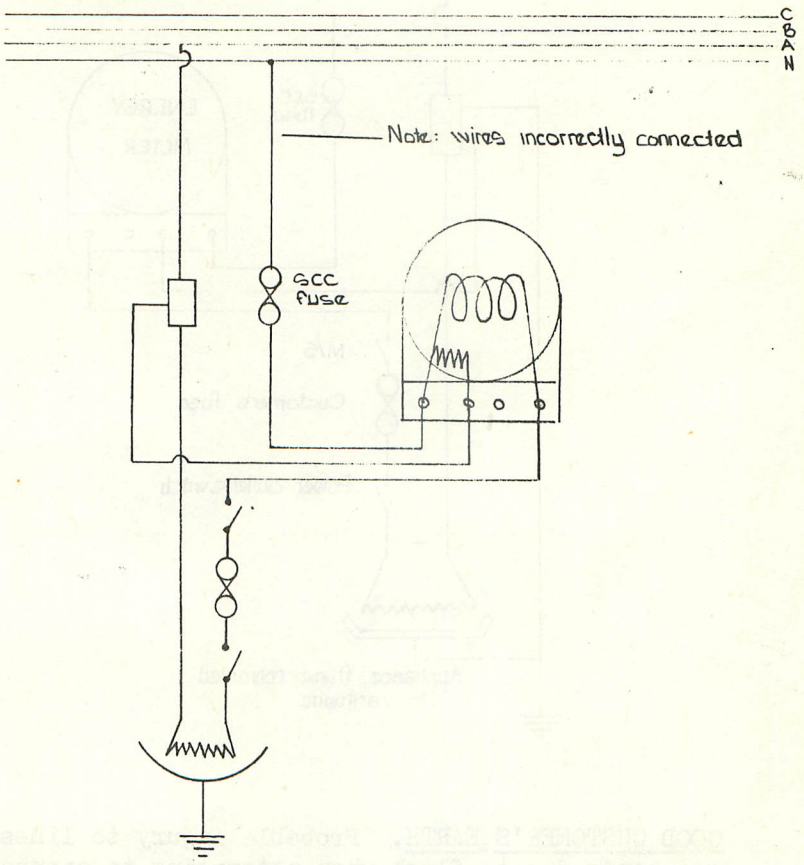
This system also has two lines of protection. The customer's earthwire is connected at one end to the water pipe as in the Direct Earth System, its other end is connected to the neutral conductor. Usually this neutral to earth connection is made at the customer's neutral link, but in some cases it is connected to the S.C.C. neutral link.

Should the customer's earthwire become broken or H.R. connection to earth, then any active fault to frame will cause unrestricted flow of current via the neutral conductor to the star point of the transformer supplying the service, which will blow the customer's fuse and isolate the fault.



SECTION 10 SERVICE FAULTS AND FAILURES

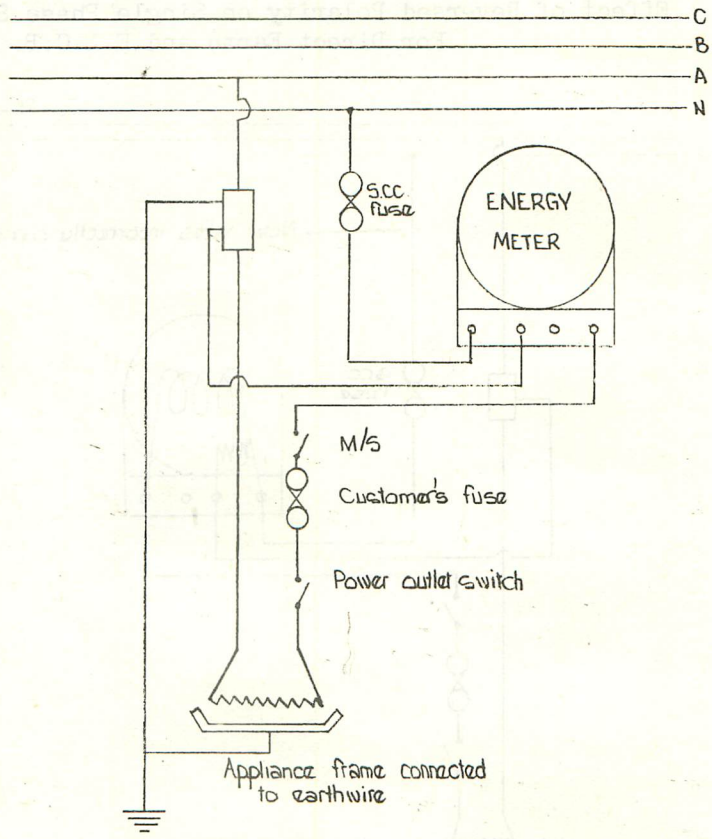
Effect of Reversed Polarity on Single Phase Service For Direct Earth and E.L.C.B.



Appliances will work normally.
A dangerous condition exists. Switch makes and breaks the neutral. Elements of appliances alive at all times, even when switched off.
(Manslaughter charge possible if fatality occurs.)

Note: To be absolutely certain that S.C.C. polarity is correct, always carry out the complete disconnection and reconnection procedure.

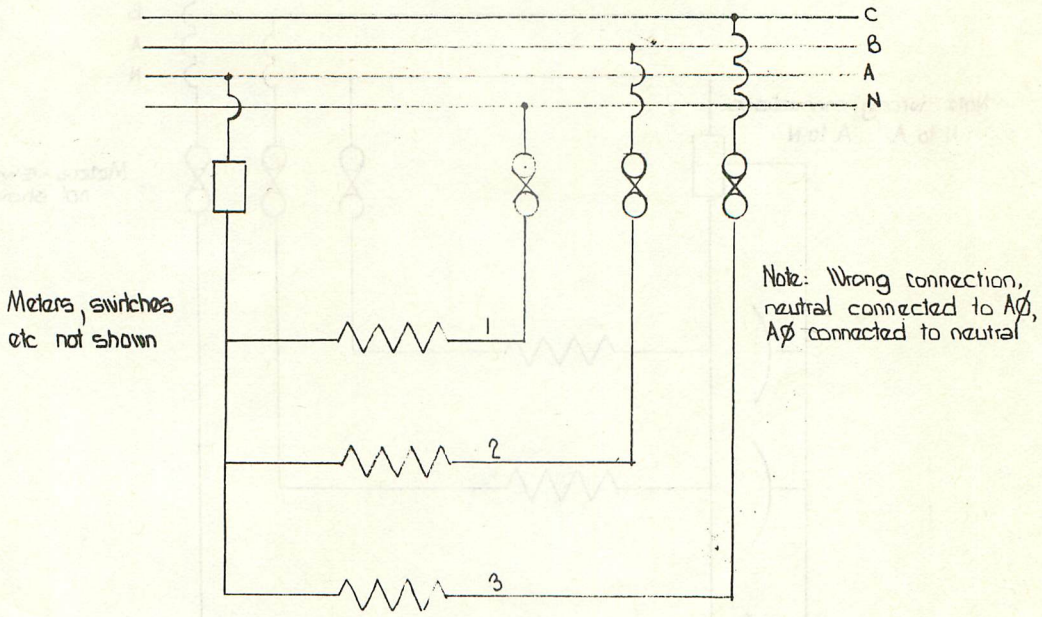
Effect of Reversed Polarity on Single Phase Service M.E.N.



GOOD CUSTOMER'S EARTH. Probable injury to linesman's eyes and hands due to flash when attempting to connect. May burn earthwire off, blow fuse in Sub or burn service wires down.
HIGH RESISTANCE EARTH could burn house down due to heating in earthwire or burn earthwire off. Elements, frames, etc. become alive. Linesman may get no indication (no arcing etc.) when connecting.
O/C EARTHWIRE. Linesman making this wrong connection would get no indication at all. A very dangerous condition would exist in the house.
Neutral and elements alive, frames, conduits, etc. also alive. Appliances would work normally.

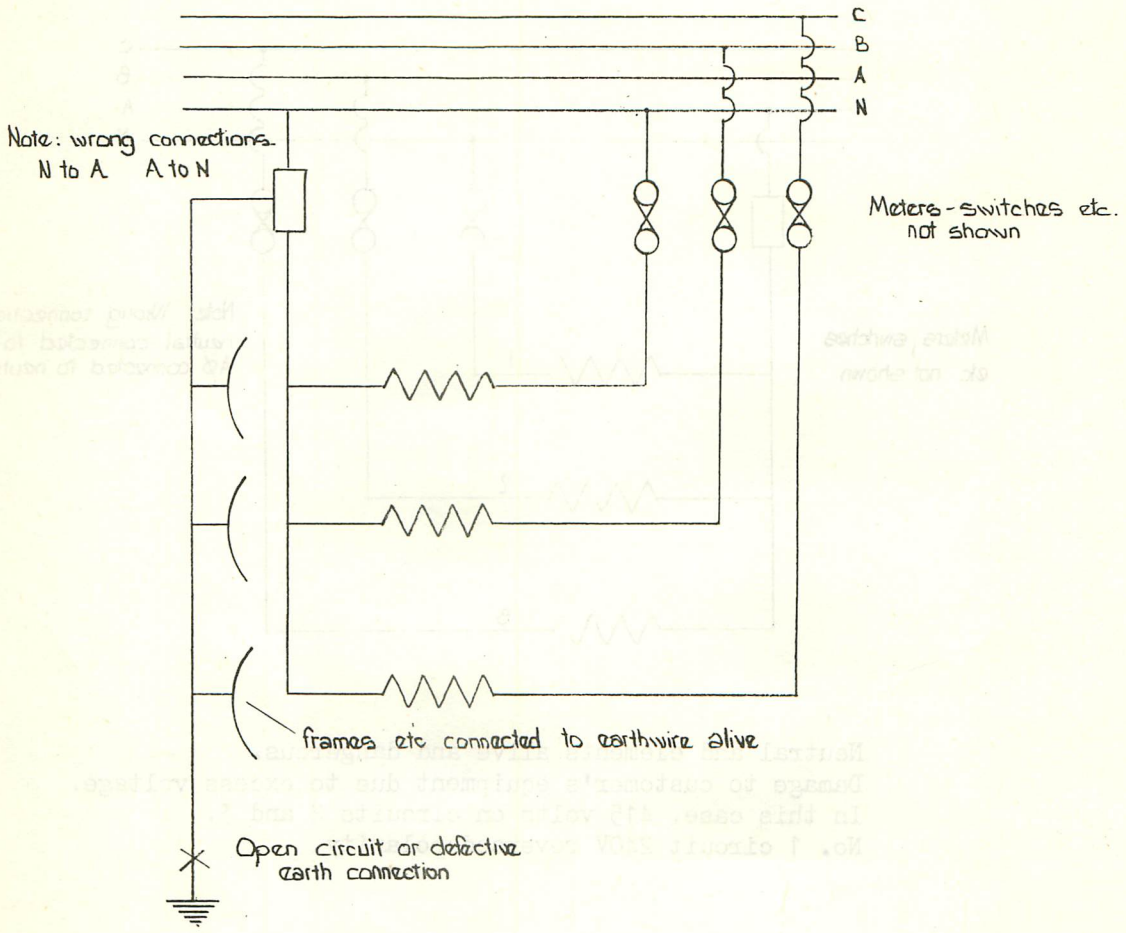
Note: To be absolutely certain that S.C.C. polarity is correct, always carry out the complete disconnection and reconnection procedure.

Effect of Reversed Polarity on Multi Phase Service For Direct Earth or E.L.C.B.



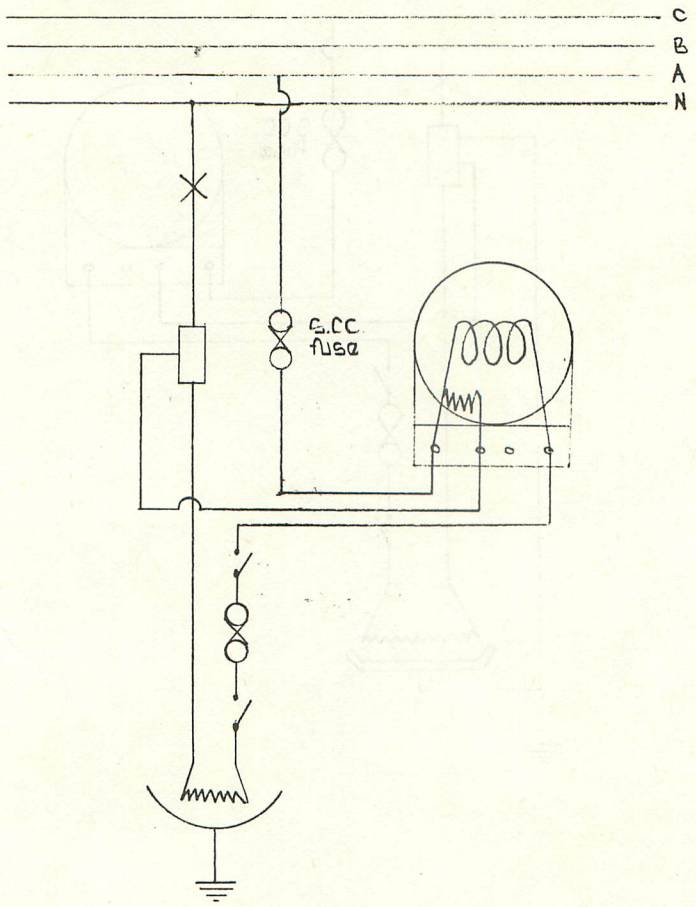
Neutral and elements alive and dangerous.
Damage to customer's equipment due to excess voltage.
In this case, 415 volts on circuits 2 and 3.
No. 1 circuit 240V reversed polarity.

Reversed Polarity Multi Phase Service, M.E.N.



Neutral elements, frames, conduits, etc. alive and dangerous.
Damage to customer's equipment due to excess voltage.
1/3 of premises = 240 volts reversed.
2/3 of premises = 415 volts.

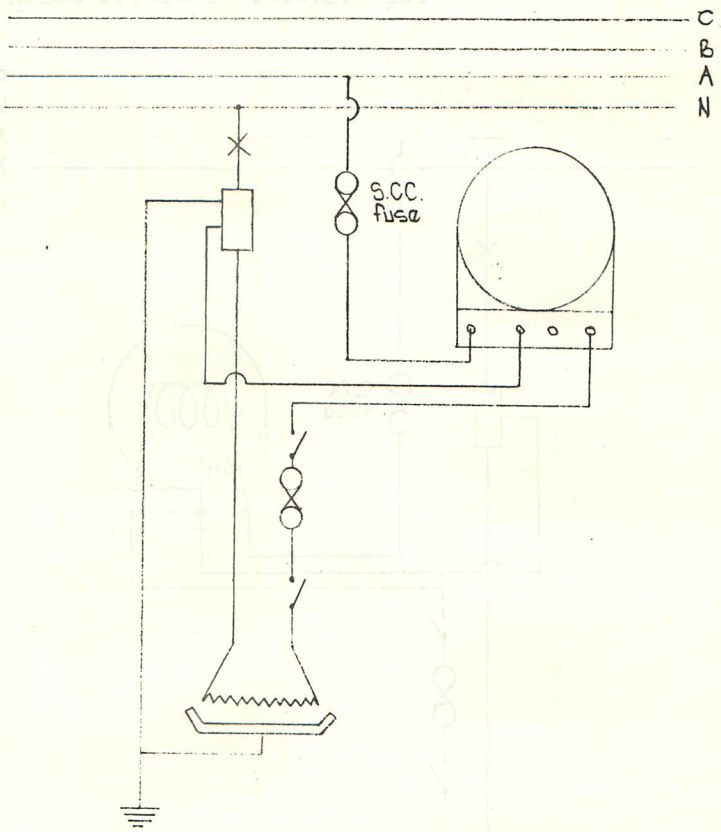
The Effects of Broken Service Neutral on a Single Phase Service for E.L.C.B. or Direct Earth



Equipment would not work.
No damage to customer's equipment.
All neutral wires alive and dangerous, elements etc. alive even when switched off and customer's fuse drawn.

Note: Draw S.C.C. fuses before attempting repairs.

Effect of O/C Neutral in M.E.N. System - (A)



Single Phase

If customer's earth good, M.E.N. system service will work normally.

H.R. Earth

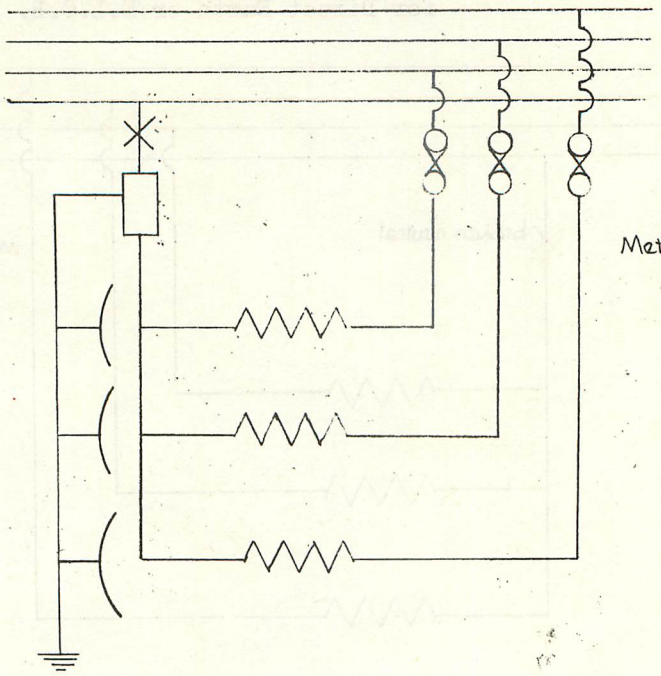
Heating could take place. Frames etc. alive.

O/C Earthwire

Equipment would not work. All elements, frames, etc. alive and dangerous.

Note: Draw all S.C.C. fuses before attempting repairs.

Effect of O/C Neutral in M.E.N. System - (B)



Multi Phase

Good Earth

Everything will work normally.

H.R. Earth

Heating when load unbalanced, unstable phase voltage.

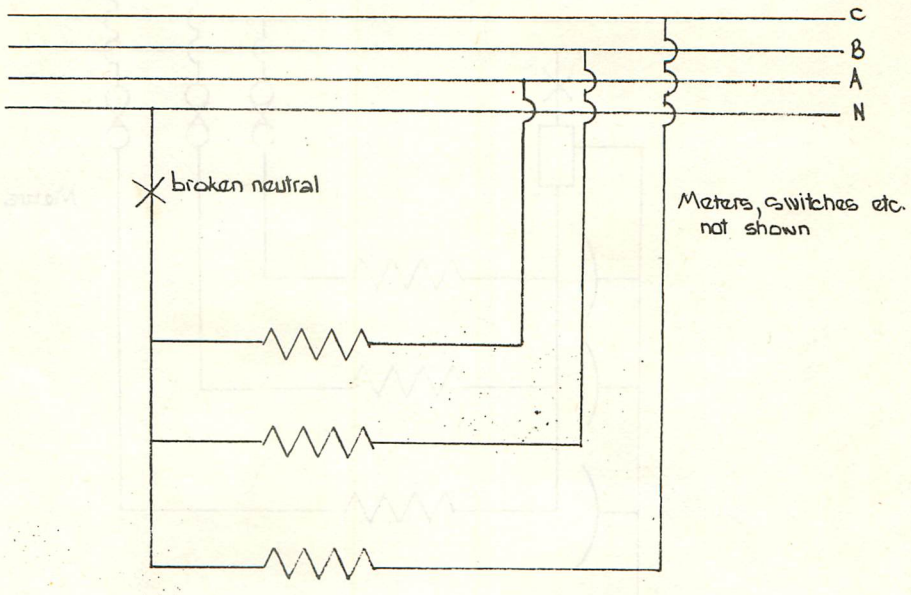
O/C Earthwire

All neutrals, elements, frames, etc. alive and dangerous.

Damage to customer's equipment due to excess or reduce voltage if two or more appliances connected to different phases are switched on at the same time.

Note: Draw all S.C.C. fuses before attempting repairs.

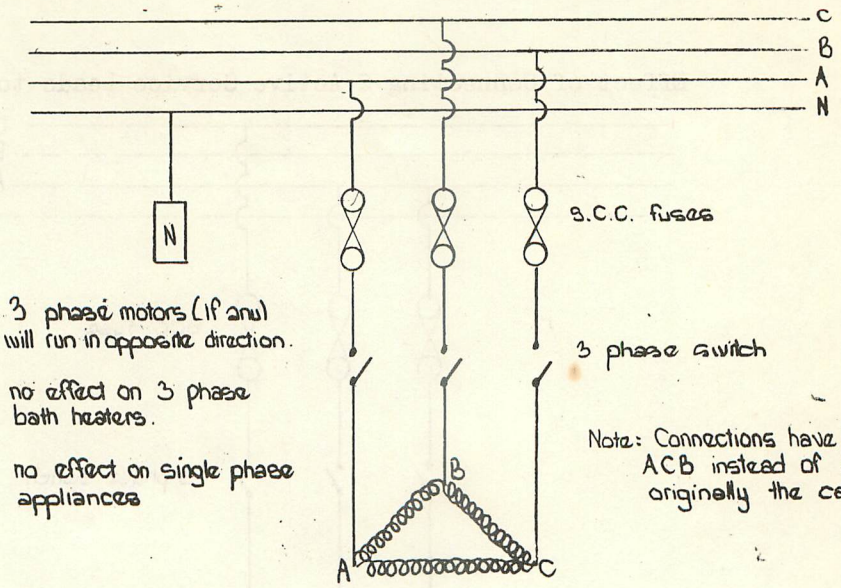
Effect of Broken Service Neutral on Multi Phase Service
for Direct Earth or E.L.C.B.



Damage to customer's equipment due to excess or reduced voltage if two or more appliances connected to different phases are switched on at the same time.
All neutral wires, elements, etc. alive and dangerous.

Note: Draw S.C.C. fuses before attempting repairs.

Effect of Reversed Phase Sequence on 3 Phase Service



3 phase motors (if any) will run in opposite direction.

no effect on 3 phase bath heaters.

no effect on single phase appliances

Note: Connections have been made ACB instead of ABC. as was originally the case

CROSSES AND ROLLS

Effect on 3 phase motors

If a 3 phase motor was originally connected A.B.C. then

CROSSES

A. C. B.
B. A. C.
C. B. A.

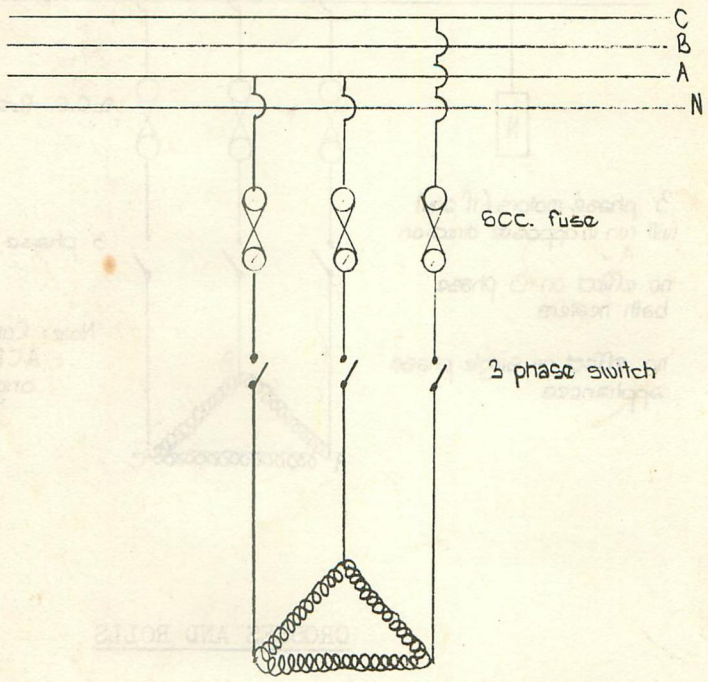
} any of these combinations will make the motor run in reverse.

ROLLS

A. B. C.
B. C. A.
C. A. B.

} any of these will make motor run in same direction.

Effect of Connecting 2 Active Service Leads to the Same Phase



Damage to 3 phase motors.
Reduced efficiency of 3 phase bath heaters, instantaneous type.
Unbalanced load on network.